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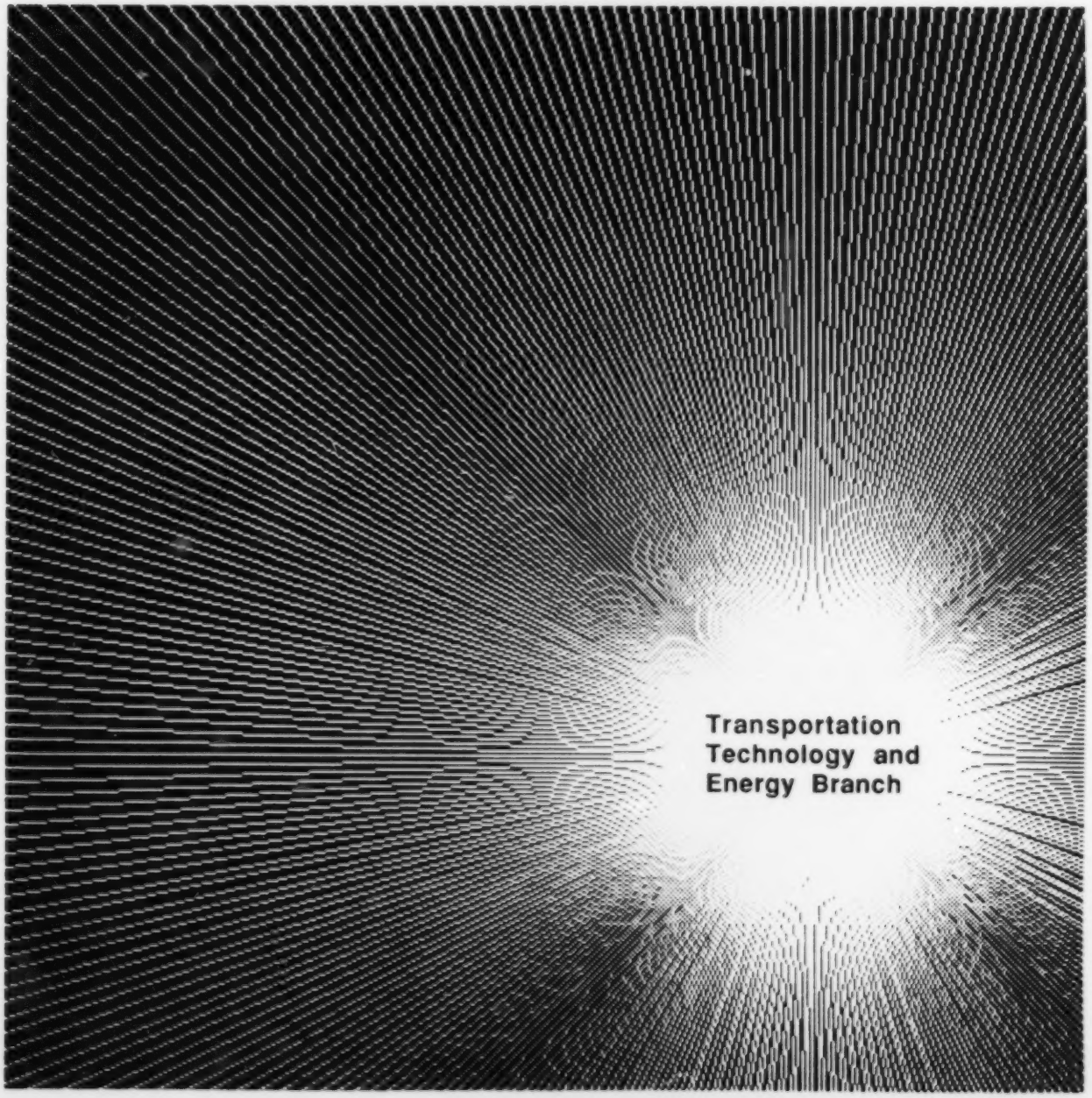

Understanding Changes in Commuting Patterns in the Greater Toronto Area 1981 - 1986

TCT-92-02

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Understanding Changes in Commuting Patterns in the Greater Toronto Area 1981 - 1986

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EXECUTIVE SUMMARY

This report examines the commuting changes that have occurred in the Greater Toronto Area (GTA) between 1981 and 1986 and identifies some of the development and transportation factors that have produced these changes. The labour force resident in the GTA increased by about 350 000 between 1981 and 1986 and employment by a greater amount, which is reflected in increased commuting from residential areas outside of the GTA.

Figure A illustrates the changes in resident labour force and employment between 1981 and 1986. The interesting features illustrated are the relatively small growth in employment in Planning District (PD)#1, the modest changes in the rest of Metropolitan Toronto (except in northeastern Scarborough), and the rapid growth of resident labour force in the surrounding regional municipalities.

The attached table summarizes the changes by major sub-area within the GTA. The dominant growth area between 1981 and 1986 was Mississauga, where resident labour force increased by 45 000 and employment by more than 50 000. This balanced increase in labour force and employment produced a massive increase in commuting within Mississauga. Job increases in PD#1, Brampton, Vaughan, Markham, and Durham Region were each in the 20 000 to 30 000 range and many of these areas had roughly equal increases in resident labour force. In spite of the nominal balance of growth in these areas, the commuting demand responses were different within most of these areas because of socio-economic incompatibility between labour force and jobs.

Much of the increased commuting generated by the labour force resident in PD#1 was to jobs within this central area. Much of the remainder of the labour force required by the job growth in PD#1 was attracted from labour force resident in the higher occupation status outer residential areas.

The socio-economic imbalance between resident labour force and employment in Vaughan (similar to Mississauga at the end of the 1980s) produced substantial increases in both in-commuting and out-commuting. The higher occupation status resident labour force developed strong commuting linkages with jobs in PD#1 and North York, while the lower occupation status jobs attracted labour force from a variety of residential areas dispersed along the freeway network. The commuting response in Markham was different from that in Vaughan. While Markham also produced strong higher occupation status linkages to jobs in PD#1, the substantial growth of local higher occupation status employment produced significant increases in intra-zonal commuting.

The commuting structure generated by the growth in resident labour force and employment in Durham had a different character. Labour force resident in Pickering, Ajax, and to a lesser extent, Whitby, produced relatively strong increases in commuting to jobs in PD#1 and Scarborough. The strong job growth in Oshawa produced important increases in intra-regional commuting. The high mobility provided by GO Transit and Highway 401 had important impacts on the linkages developed from these urban areas.

The commuting produced by labour force resident in Oakville and Burlington had a similar character to that produced by Durham Region. Important increases occurred to jobs in Mississauga and PD#1, while Burlington produced important increases in commuting to Hamilton. Within Hamilton, resident labour force was greater than employment growth and commuting to the Toronto Census Metropolitan Area (CMA) and to new jobs in Stoney Creek were the most important changes.

Figure B shows the changes in commuting travel kilometres produced and attracted by each of the zones within the GTA. The important producers (i.e., from the residential end) were northeastern Scarborough, Mississauga, Brampton, Vaughan, Markham, and to a lesser extent, Durham Region. The important attractors of new commuting demand (i.e., to the employment end) were PD#1, Mississauga, Vaughan, and Markham, and to a lesser extent employment areas in the Yonge Street corridor and northeastern Scarborough.

The major transportation routes such as GO Transit and the provincial freeway system have had an important impact on the nature of the commuting linkages that developed between 1981 and 1986. GO Transit, the QEW, and Highways 401 and 400 have conditioned the commuting linkages along these corridors and stimulated relatively long trip lengths.

SUB-AREA	ACTIVITY CHANGES Lab.Force	Jobs	COMMUTING CHANGES	DEVELOPMENT & TRANSPORT FACTORS
PD#1	13,000	27,000	increased intra-zonal travel and commutershed extension to outer residential areas	new apartments and other higher density housing forms in central area; radial transit system influence plus freeways
Inner Areas	10,000	9,000	modest increases in commuting to PD#1	continued gentrification with growth in higher status, smaller households; 5,000 job reduction in PD#3; TTC access to PD#1
Etobicoke	4,000	16,000	increased commuting to jobs in central Etobicoke from northern Etob. & Mississauga	modest labour force growth in north & employment growth in central area; major influence of freeway system
North York	6,000	8,000	reverse commuting increase to Vaughan jobs & increased commuting to jobs in North York centre from adjacent areas	modest labour force growth along north Metro boundary; modest employment growth in North York centre; freeway access plus TTC for reverse commuting
Scarborough	32,000	18,000	sharp increases in commuting to PD#1 from higher status n-e; increased commuting to Scarborough Town Centre, Markham & modest increases along 401 corridor	strong labour force & job growth in n-e corner; large increase in intermediate & smaller household sizes due to detached housing increase;TTC access to PD#1 and freeway network
Mississauga	45,000	52,000	massive increase in intra-zonal commuting; strong reduction in growth of commuting to PD#1; increase in reverse commuting to jobs adjacent to Airport	large increases in labour force & job growth in both white & blue collar sectors; large increase in detached housing & higher density housing forms with increases in small & intermediate household sizes; strong freeway impact to & from new areas
Brampton	26,000	22,000	increased commuting to Mississauga & moderate increases to PD#1, Vaughan & Etob.	detached housing increase plus apartments; increases in small & intermediate household sizes; strong freeway & regional road impact
Vaughan	20,000	22,000	large increases in commuting to Metro, particularly PD#1 & North York centre; increase in long distance commutershed to lower status jobs in Vaughan	detached housing dominated housing supply; intermediate household sizes dominated increase; higher occupation status labour force; freeway impact on commuting to Vaugh. jobs

SUB-AREA	ACTIVITY CHANGES Lab.Force	Jobs	COMMUTING CHANGES	DEVELOPMENT & TRANSPORT FACTORS
Markham	24,000	28,000	large increases in intra-zonal commuting, Scarborough & PD#1	detached housing increase dominated; intermediate sized-households increased and compatible local job increase; freeway impact on Markham attractions
Rest York	16,000	13,000	modest increases in intra-zonal travel, travel rest York and Metro	housing supply increase mainly in detached units; intermediate household size increase
Durham	29,000	28,000	increased commuting from Pickering, Ajax & Whitby to PD#1 & Scarborough; job increase in Oshawa provided anchor for intra-regional commuting	mixed increase in housing forms and household sizes; strong job increase in Oshawa; GO Transit and 401 dominant influence on commuting structure
Oak./Burl.	14,000	17,000	increases in local commuting, to Mississauga & PD#1; Burlington-Hamilton reverse commuting increase	equal increases in small & intermediate household sizes in Oakville; intermediate household sizes dominated in Burlington; strong GO Transit & QEW impact on commuting structure
Hamilton R.	10,000	-	increase in commuting between Hamilton & Stoney Creek	minor increases in resident labour force in Hamilton, Ancaster and Stoney Creek; job decrease in Hamilton

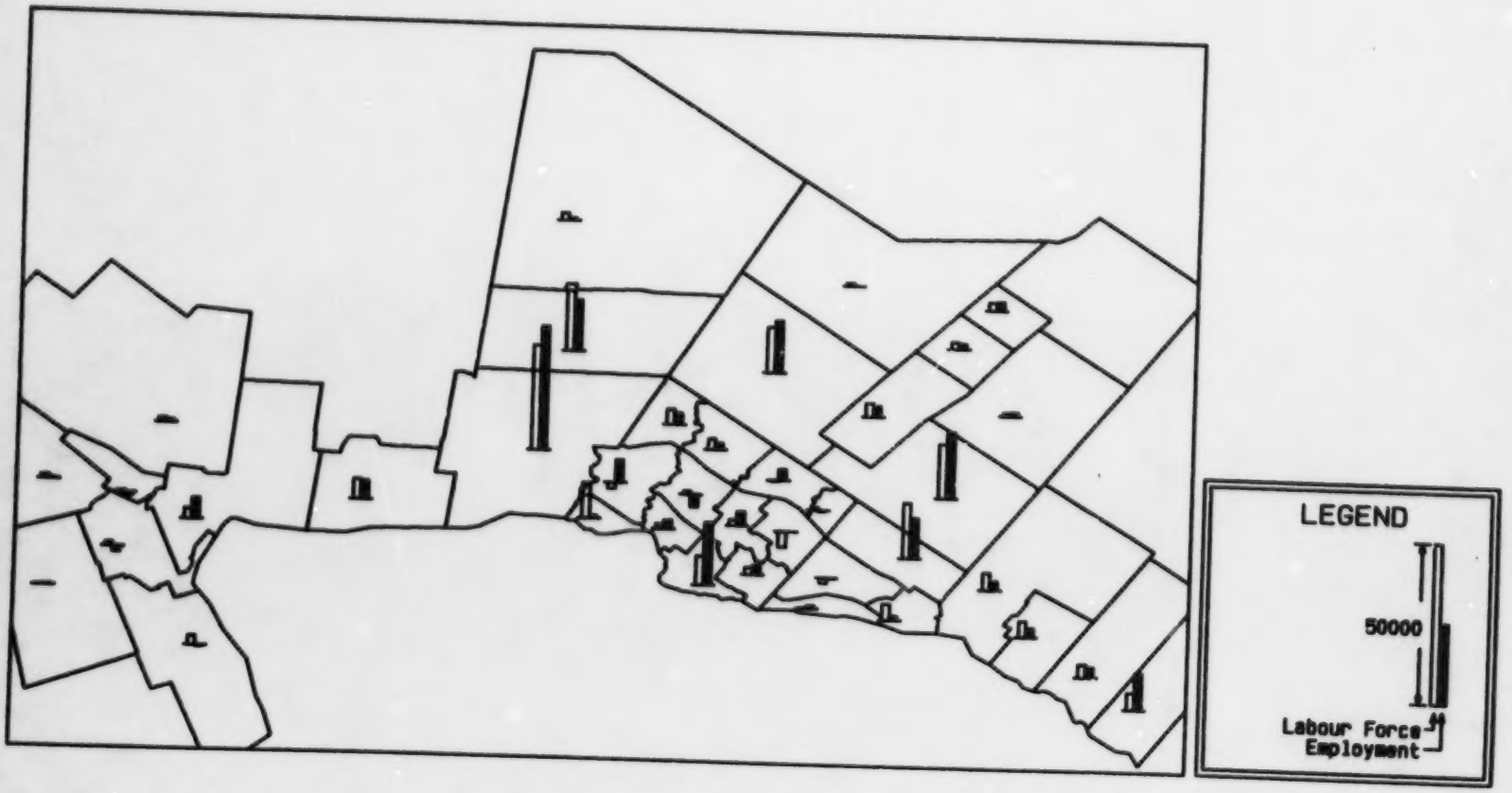

Figure A. Changes in Resident Labour Force and Employment between 1981 and 1986

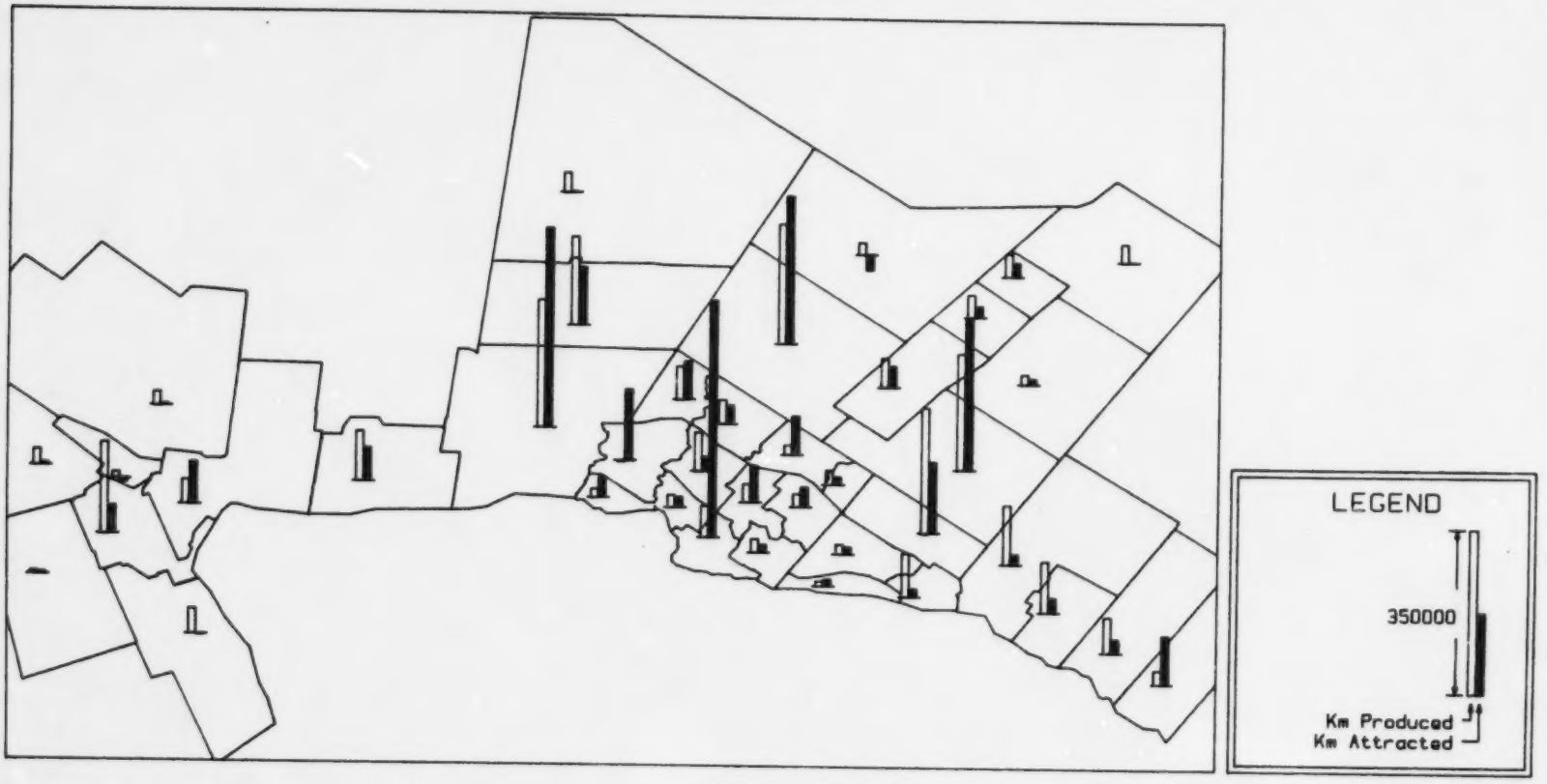

Figure B. Changes in Commuting Kilometres Produced and Attracted between 1981 and 1986

PREFACE

This is the final report in a series of four reports generally entitled *Understanding Changes in Commuting Patterns in the Greater Toronto Area 1981-1986.* The earlier reports in this series are subtitled:

Analysis at the 46-Zone Level
October 4, 1990

Detailed Analysis of Commuting from External Zones and within Growth Areas
November 29, 1990

Evaluation of Trip Distribution Model Capabilities
May 6, 1991

ACKNOWLEDGMENTS

The research project on which this report is based was under the general direction of Mr. Ryerson Case, Manager, Traffic and Decision Systems Office, Transportation Technology and Energy Branch.

Technical direction was provided by Mr. Murray McLeod, Manager, Transportation Demand Research Office and several staff members from this office: Mr. James Wong, Mr. Pentti Suokas, and Mr. Bill Rhamey. The contributions of these individuals to this study are gratefully acknowledged. Mr. James Wong was particularly helpful in providing the necessary data files.

1/ LOCATION DECISIONS AND COMMUTING DEMANDS

The Greater Toronto Area (GTA) has grown rapidly since the 1950s and has emerged as the major conurbation in Canada. The area has often been cited by land use and transportation planners as an example of an area that has adopted enlightened planning and transportation policies over a long period. The adoption of a metropolitan form of government in the 1950s, the integrated nature of land use and transportation planning in the area, the substantial investments in public transportation facilities along with the provision of a high mobility freeway network are some of the components of public policy that have attracted attention. The current regional planning initiatives may lead to the formulation of development guidelines that will steer the GTA on a long-term development course as the region continues to expand and embrace urban areas in the municipalities adjacent to the GTA, such as, Wellington, Waterloo, Niagara, Dufferin, and Northumberland.

The broad goal of the research project on which this report is based was to develop an objective understanding of the way in which land development and transportation policies have influenced the evolution of commuting patterns in the area. The questions about changes in commuting patterns posed by the Ministry of Transportation of Ontario (MTO) in defining the focus of the research project included:

- What have been the general changes in the spatial distribution of travel?
- Have the levels of commuting self-containment increased as communities have matured?
- What has been the increase in the commutershed of Metropolitan Toronto and have the suburban job centres begun to intercept some of the travel from the outlying residential areas?
- What changes in trip lengths have occurred across the GTA?
- What has been the impact of freeways and higher order transit links on the structure of the commutershed?

These five questions guided the research project which focussed mainly on the evolution of the area between 1981 and 1986. However, information developed in earlier studies is also incorporated into this report to provide a longer-run historical perspective of the spatial dynamics of the GTA and the changes in commuting.

1.1/ The Conceptual Framework

The location decisions made by households and firms (including governments, etc.) and the travel opportunities provided by transportation agencies are the primary determinants of commuting demands in a region. These location decisions are

conditioned by the characteristics of the locators, such as household size, income, and the type of business conducted by firms, and the relative accessibilities of areas to related activities. Figure 1 offers a conceptual framework for tracking the interconnections between location decisions, travel demands, and travel effort. The diagram suggests that the basic driving forces are the region-wide demands for household and employment location and that these location demands are satisfied through the land market, where this market is influenced by planning policies and the characteristics of the transportation system. The components of this conceptual framework are described in more detail in the following paragraphs. The framework provides the basis for the organization of this report.

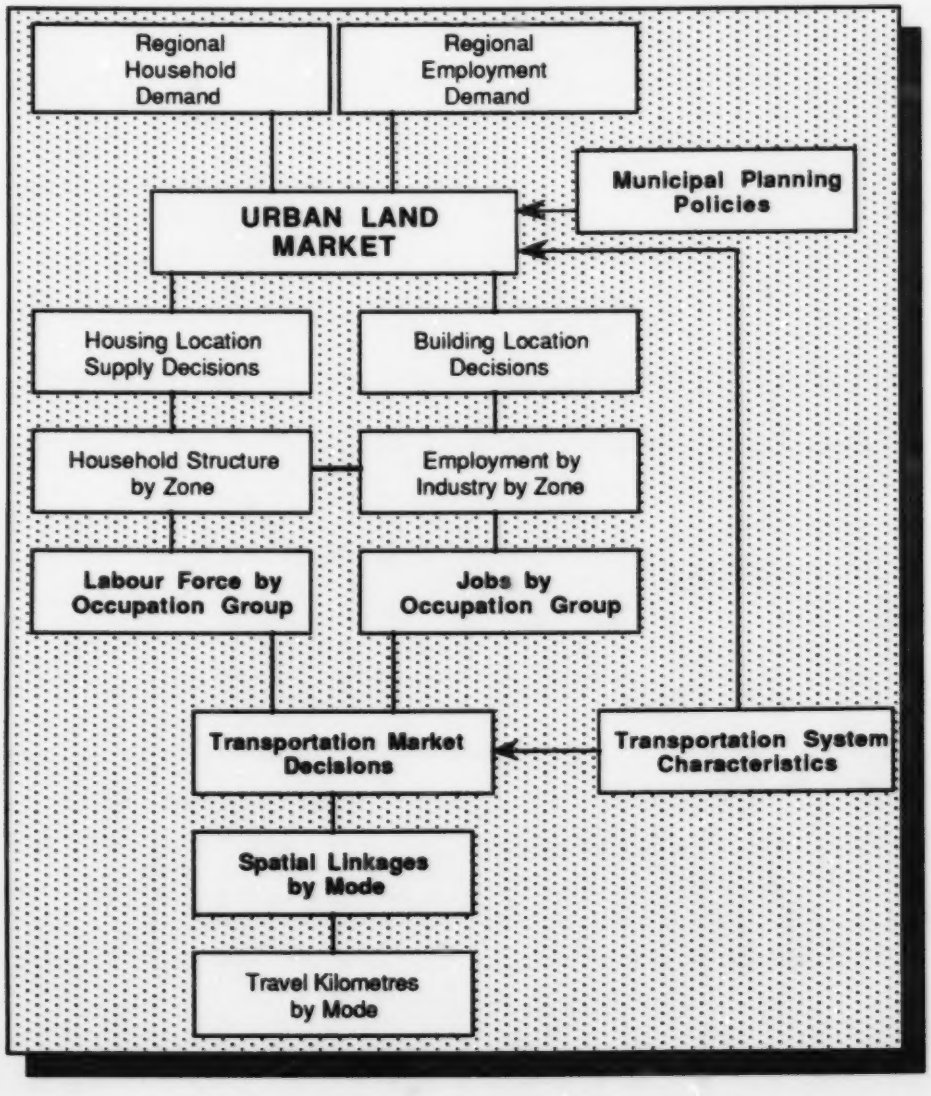

Figure 1/ A Conceptual Framework for Location and Transportation Decisions

1.1.1/ Regional Household Demand

The location decisions by households are a joint consequence of household characteristics, land use planning policies, the characteristics of the real estate market, and travel opportunities. The primary factors influencing housing location decisions of households are household size, household income (which is often expressed through occupation status), accessibility to places of work for the household labour force, and the price of housing at various locations. Examples of other factors that have been shown to influence housing type choice and location decisions are age of household head, car ownership, and ethnic associations to particular sub-areas of an urban region.

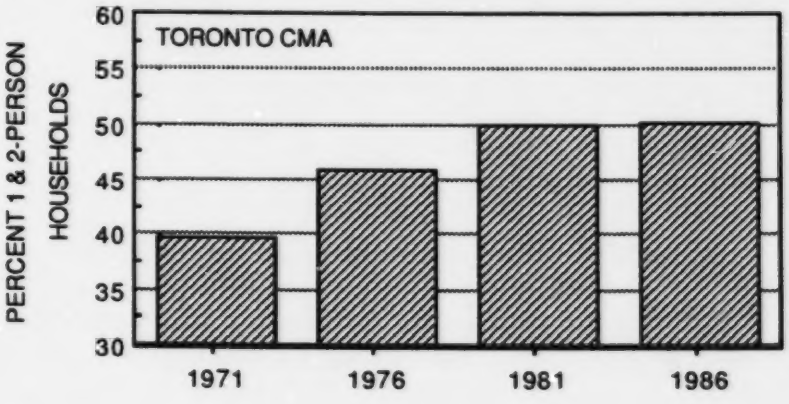

Figure 2/ Trends in the Percent of One- and Two-Person Households in the Toronto CMA, 1971-1986

Household sizes have changed dramatically in the GTA over the past 25 years. Figure 2 shows the trends in the percentage of one- and two-person households in the Toronto Census Metropolitan Area (CMA) between 1971 and 1986. The diagram shows that one- and two-person households now account for about 50% of the total households in the CMA. A number of factors have contributed to this shift and these include the sharp increase in female labour force participation rates, the decline in birth rate, and the overall increase in household income. The decrease in average household size has meant that the number of households has grown much faster than the population and that the composition of the demands for the different housing types has changed. These changes in demand for different housing types have had important impacts on the location decisions of households, particularly the decisions of the smaller household sizes.

1.1.2/ Regional Employment Demand

Employment composition is not recorded at the place of work during the census but it is possible to obtain an impression of the structural changes in employment in an area by examining the labour force data recorded in the census. Figure 3 shows the change in the composition of the employment base in the Toronto CMA between 1961 and 1986, where the specific sectors highlighted are manufacturing, trade, and services (community, business, and personal services).

Figure 3 shows that in 1961 the manufacturing sector was the dominant employment type in the Toronto CMA and that it had decreased to third rank by 1986. The diagram shows that the manufacturing and trade sectors have grown steadily during the 15-year period but the highest growth rate has been in the services sector. This structural shift in the employment composition of the region has had important implications for employment location decisions and transportation demand by mode.

1.1.3/ Housing Location Supply Decisions

The housing supply decisions made by developers are influenced by municipal planning policies, perceptions of demand factors, and attempts to maximize profit from development decisions. There are important spatial biases in the supply of housing stock by housing type and Figure 4 shows these spatial biases for the Toronto CMA in 1986 and shows the supply of single family housing stock as a percent of total housing supply in each zone in 1986.

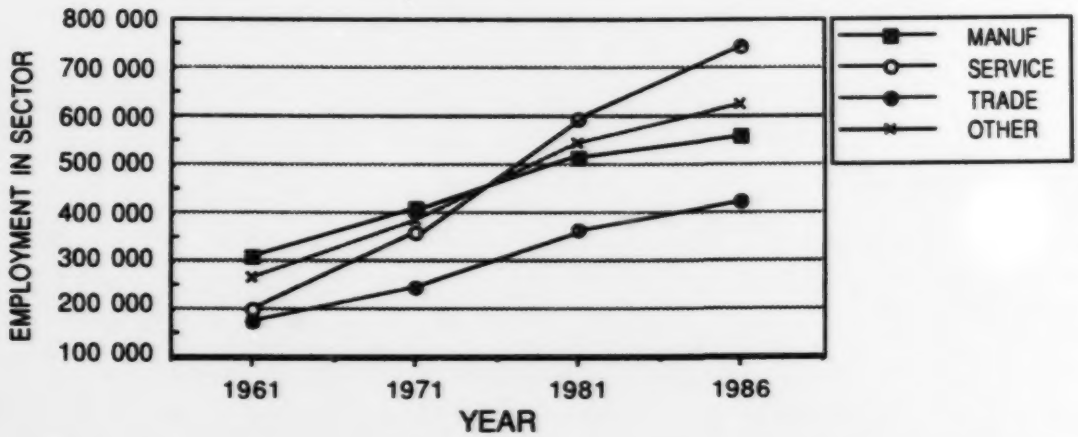

Figure 3/ Growth in Employment by Sector in the Toronto CMA, 1961-1986

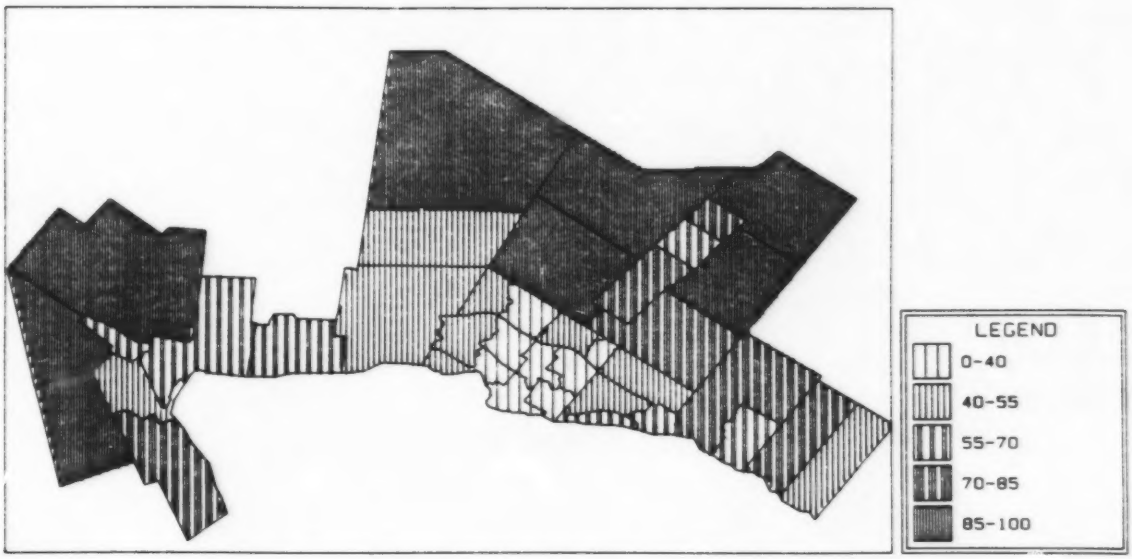

Figure 4/ Single Family Dwelling Units as a Percent of Total Housing Stock in 1986

Figure 4 illustrates that the lowest concentrations of single family dwelling units are in the Cities of Toronto, York, and North York. Scarborough, Etobicoke, Mississauga, Oshawa, and Hamilton contain the next lowest concentrations of single family units while Markham, Pickering, parts of Oshawa, Stoney Creek, and the outer municipalities contain the highest concentrations of single family units.

1.1.4/ Employment Distribution by Industry Type, Zone, and Occupation Group

The shifts in the composition of the employment base have important implications for the spatial distribution of employment in a region and ultimately for the spatial distribution of housing demand by housing type. The office-based employment sectors tend to locate towards the central area while the manufacturing and trade sectors tend to locate in the suburbs. Figure 5 shows the spatial distributions of manufacturing and FIRE (finance, insurance, and real estate) employment in 1981. The manufacturing employment is concentrated in the suburbs while the FIRE employment has strong concentrations in the central employment area. However, these conventional location patterns tended to emerge differently in the past decade with many of the office-based sectors locating in suburban offices and business parks. Unfortunately, data on the spatial distribution of employment by industry sector were not available from the 1986 census.

The occupation composition of the different industry sectors varies substantially and this variation has important impacts on the spatial distribution of housing demand by housing type. Table 1 shows the occupation composition of the major industry types for Canada as a whole in 1986. The table entries indicate that the largest concentrations of managerial and professional occupation groups are in the business and social services industries. Manufacturing and consumer services contain the largest concentrations of the lower occupation status employees

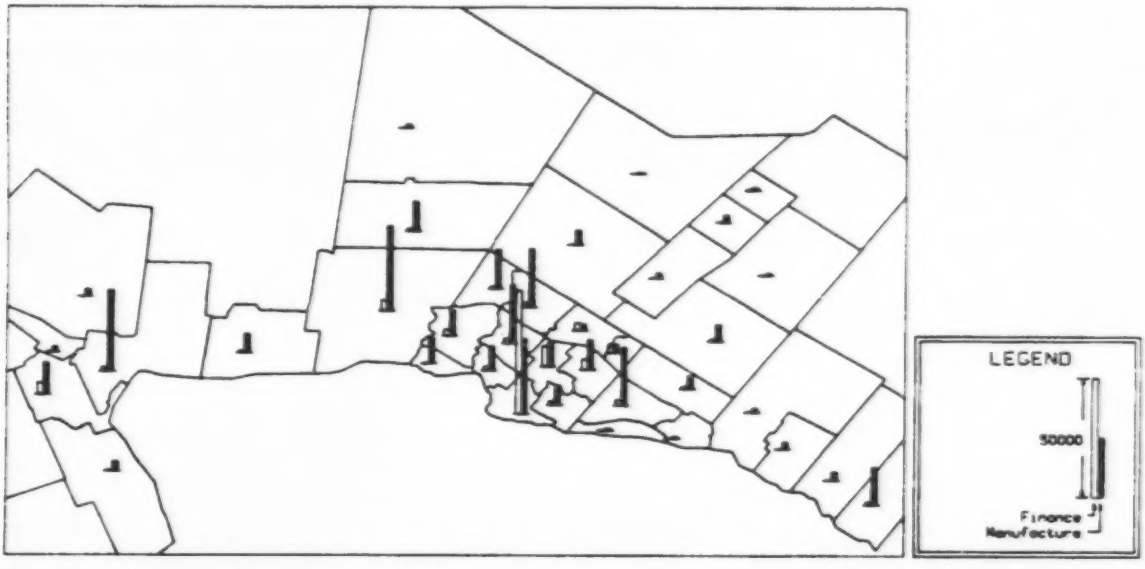

Figure 5/ Spatial Distribution of Manufacturing and FIRE Employment in 1981

Differences in the spatial distribution of employment by industry type produce differences in the spatial distribution of employment by occupation type and Figure 6 shows this distribution for 1981. It shows that the white collar occupation status jobs are concentrated within Metropolitan Toronto, particularly in the office concentrations along the Yonge Street corridor. The higher concentrations of blue collar occupation status jobs are located in the northwestern corner of Metropolitan Toronto, Mississauga, Oshawa, and Burlington.

Table 1/ Occupation Composition by Industry Type in Canada in 1986

Occupation Type	Industry Sector					
	Manuf.	Distrib. Services	Business Services	Consumer Services	Social Services	Other
Managerial	17	14	23	12	10	24
Professional	7	5	11	8	59	10
Clerical	11	17	21	22	12	17
Sales	8	14	15	60	-	3
Service	2	2	5	62	14	15
Process+Fabr.+Other	42	20	2	12	2	22

1.1.5/ Household Structure by Zone and Occupation Group

Household decisions about housing type are influenced by household size and income, where household income is influenced by the labour force participation rate of households and the occupation status of the labour force. Figure 7 illustrates the 1981 spatial distribution of resident labour force by occupation group, where this distribution should be compared with that shown in Figure 6.

The diagram clearly illustrates the socio-economic differentiation that existed in 1981 in the spatial distribution of labour force within Metropolitan Toronto. The white collar occupation groups were more strongly represented in the planning districts along the Yonge Street corridor and to the east. Exceptions were PD#2, immediately to the east of the Toronto central area and PD#8 in the central section of Toronto. The white collar occupation domination in Markham and Mississauga (although less strongly than Markham) may be noted from the diagram. The influence of the manufacturing bases in Oshawa and Hamilton on the occupation status composition in 1981 is clearly illustrated.

This spatial differentiation in occupation status is further illustrated by Figure 8 which shows the distribution of resident labour force by occupation status in the Cities of York and Markham. The diagram illustrates very clearly the larger concentration of managerial and professional labour force that lived in Markham in 1986. The City of York had larger concentrations of labour force in the service and other (processing, fabrication, construction) occupation categories.

Figure 9 shows the spatial distribution of households by two size groups in 1986 and the diagram shows that the smaller household sizes tend to be concentrated in the inner suburbs with the larger household sizes concentrated in the outer suburbs.

1.1.6/ Transportation Market Decisions

Figure 1 suggests that transportation market decisions should be considered in the context of the spatial distributions of resident labour force, employment by occupation group, and the travel opportunities provided by the transportation system. These market decisions include the choice of a commuting trip length and a mode of travel. Classical household location theory hypothesizes that households make location decisions by considering the trade-off between housing prices, housing type, and transportation costs. An important component of housing costs is land price and land prices decline as the distance from the central employment area increases. The consumption of more housing space is made at the expense of higher travel costs and the need for more housing space is conditioned by household size.

Figure 6/ Spatial Distribution of Employment by Occupation Group in 1981

The factors influencing modal choice decisions are relatively well understood. These include the relative travel times by competing modes, the relative costs of using the modes (including parking charges), the quality of service provided by the modes (including service frequencies), access and egress times for the different modes, and the incomes of the trip makers. It is also well known that there is a joint character to location and modal choice decisions, particularly for those who use public transportation for the journey to work.

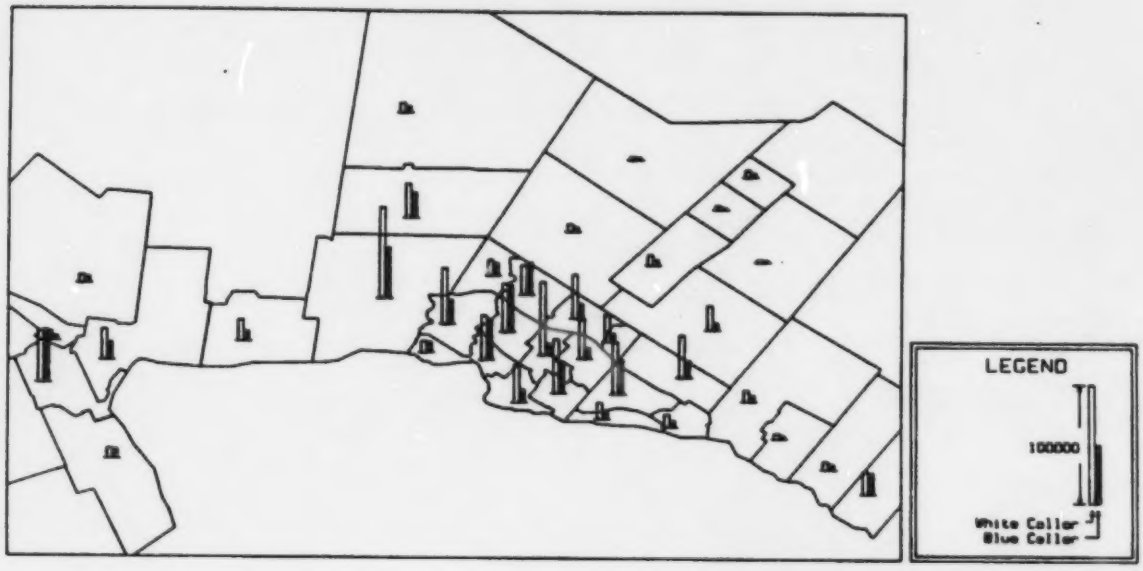

Figure 7/ Spatial Distribution of Labour Force by Occupation Group in 1981

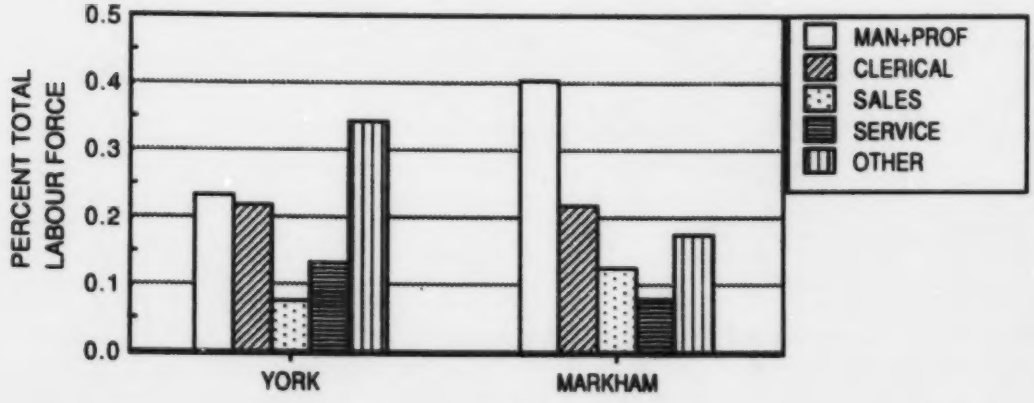

Figure 8/ Composition of Labour Force by Occupation Status in Two Municipalities

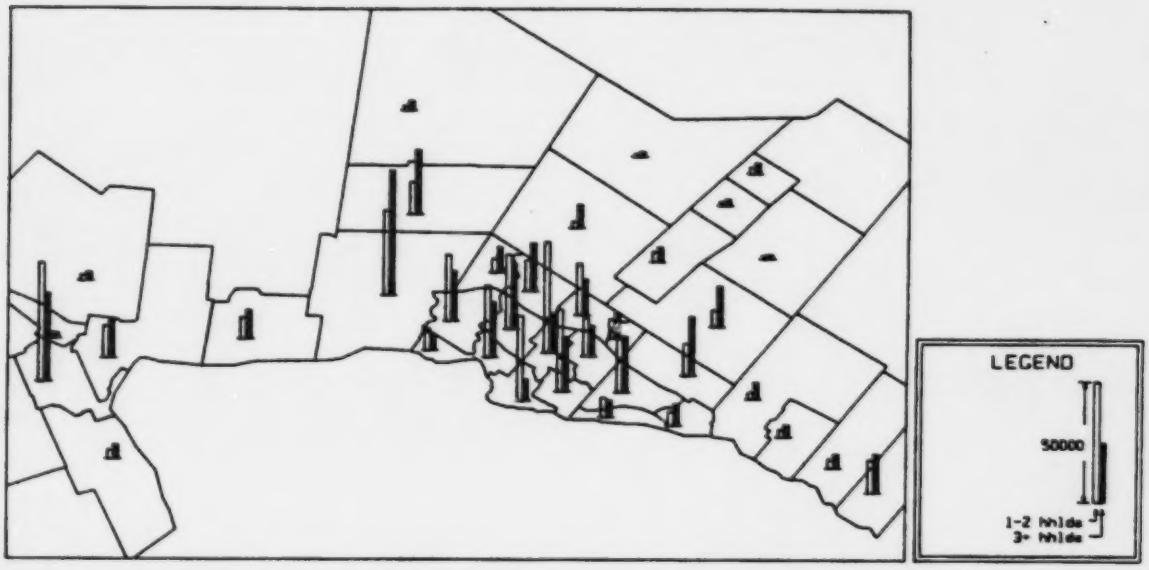

Figure 9/ Distribution of Households by Two Size Groups in 1986

The travel surveys conducted in the region in 1964 and 1986 have revealed some important changes in trip-making behaviour:

	1964	1986	% increase
average number of trips per day per person	1.3	2.1	38
average number of trips per household	4.9	5.4	10

The large increase in trips per capita reflects the increased female labour force participation rate, the faster rate of growth of households than population, the increasing percent of adults in the total population, and the increased car ownership which stimulates larger numbers of non-work trips.

Figure 10 shows the structure of the commutershed for PD#1 in 1986 and the very strong radial character of this demand may be noted, as well as the long distance nature of this travel along some of the major corridors such as the Lakeshore and Yonge Street corridors.

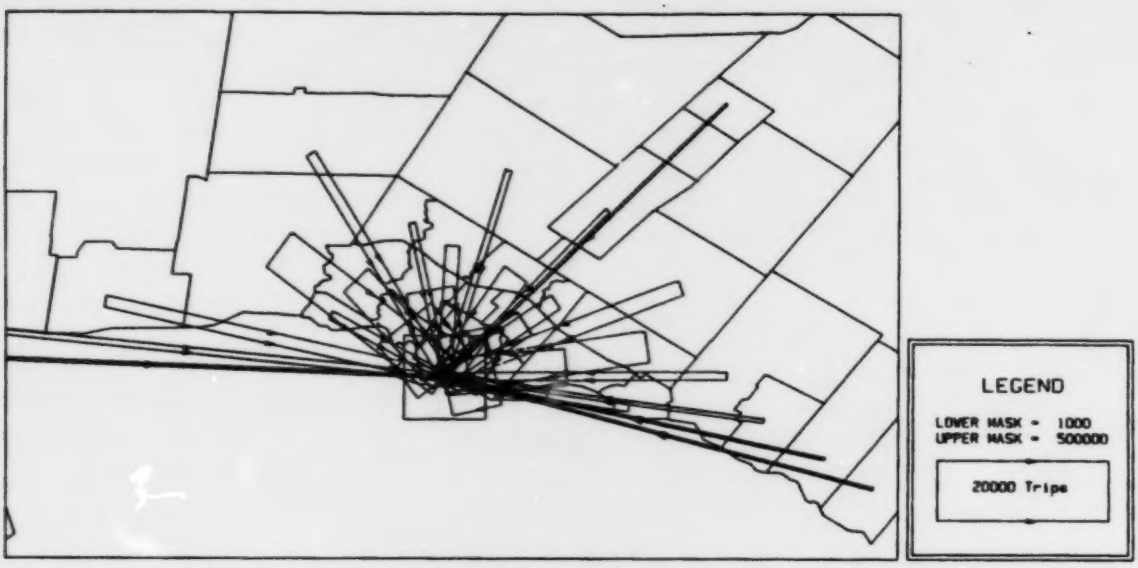

Figure 10/ The Commutershed for Employment in PD#1 in 1986

Figure 11 shows the modal split proportions observed in the Transportation Tomorrow Survey (TTS) conducted in 1986 for commuting trips to PD#1. The diagram illustrates that many of the planning districts produced roughly equal shares of car and transit travel to jobs in PD#1, although some planning districts within Metropolitan Toronto produced larger transit shares, particularly along the Yonge Street corridor and the Lakeshore GO Transit corridor.

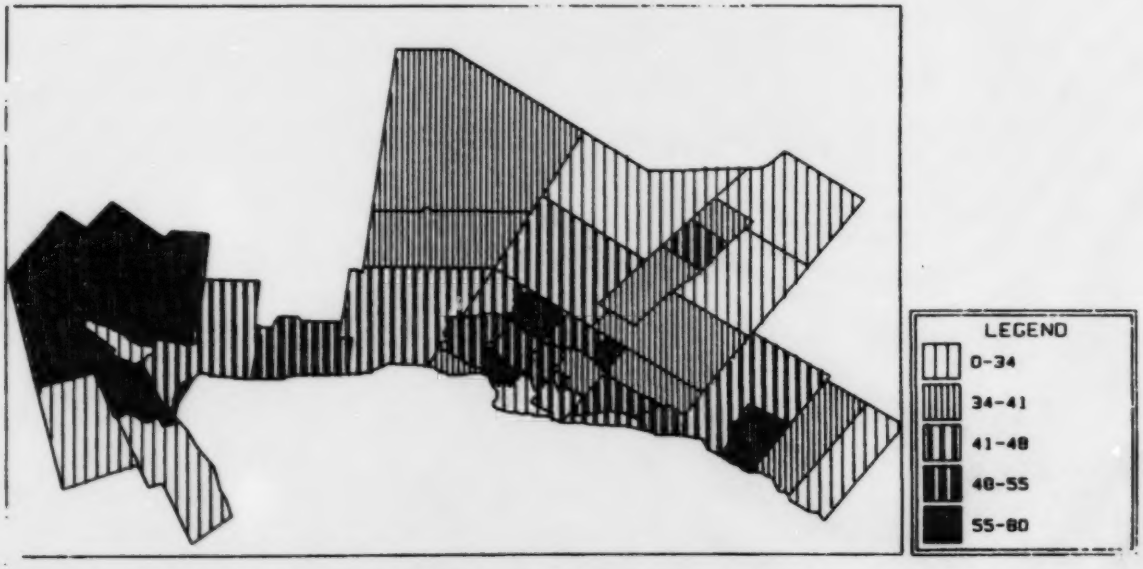

Figure 11/ Modal Split Proportions in 1986

1.2/ Structure of the Report

Chapter 2 summarizes the area-wide changes in residential and employment characteristics, including changes in labour force participation rates and age structure.

Chapter 3 describes the spatial distributions of labour force and employment in the GTA in 1986 and the associated commuting structure. It examines the commuting flows across the GTA border as well as the commuting structure within the GTA.

Chapter 4 examines the changes in the spatial structure of the GTA between 1981 and 1986 and the impact that these changes have had on commuting behaviour.

Chapter 5 analyzes the impacts of location decisions on transportation demands in more detail and addresses the specific questions posed in Chapter 1 about changes in commuting structure in the GTA.

2/ CHANGES IN AREA-WIDE CHARACTERISTICS

This chapter examines the changes that have occurred in the aggregate characteristics of the GTA during 1951-1986. While some of these changes were mentioned in Chapter 1, this chapter describes these changes more comprehensively. The conceptual framework introduced in Chapter 1 suggested that the aggregate growth in residential activity and employment needed to be understood, along with their translation into spatial distributions of labour force and employment. The characteristics examined in this chapter include population, labour force, labour force participation rates, household size distributions, and the composition of the labour force by industry type and occupation group.

2.1/ Population Changes

Figure 12 shows the population growth history of four sub-areas of the GTA between 1951 and 1986. The diagram illustrates that the population of Metropolitan Toronto increased by about 500 000 between 1951 and 1961, by about 470 000 between 1961 and 1971, and then remained relatively constant at just over 2 100 000. The diagram illustrates that the population of the remainder of the Toronto CMA increased sharply between 1961 and 1971 and that the population of this sub-area has continued to grow rapidly.

The stability of the population living within Metropolitan Toronto since 1971 is the net result of population growth along the fringes and population decline in some of the older suburbs. While population has been stable within Metropolitan Toronto, the resident labour force has continued to increase. The populations of the Hamilton CMA and the Oshawa CA have not changed very much over the 25-year period.

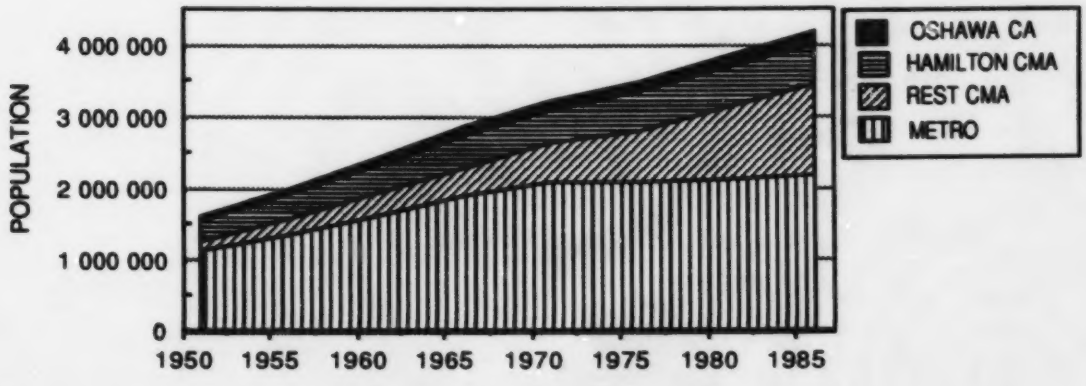

Figure 12/ Population of Four GTA Sub-Areas, 1951-1986

2.2/ Changes in Labour Force Participation

The labour force content of the population varies significantly across the GTA, where these variations reflect differences in age structure, education, and the proportion of females in the resident population. The rapid changes in female labour force participation were mentioned in Chapter 1 and variations in female labour force participation contribute to the differences in labour force participation rates. Table 2 summarizes the labour force participation rates for the three census areas in the GTA. The table entries show that the highest participation rate is within the Toronto CMA and the lowest is in the Hamilton CMA. Much of the variation in participation rates between areas is due to the differences in female labour force participation.

Table 2/ Labour Force Participation Rates by Census Area in 1986

Census Area	Male	Female	Total
Toronto CMA	0.816	0.639	0.725
Hamilton CMA	0.777	0.566	0.668
Oshawa CA	0.821	0.588	0.704

2.3/ Changes in Household Structure

A strong correlate of the changes in labour force participation rates is the change in household size. Figure 13 illustrates the change in the size composition of households between 1971 and 1986 in the Toronto CMA. The diagram reinforces the information already provided in Chapter 1 and shows that the proportion of one- and two-person households has increased from about 40% in 1971 to about 50% in 1986. This shift is due mainly to the reduction in the numbers of very large households (> 6 persons). A major component of the growth in the smaller household sizes is the sharp increase in the number of female household heads.

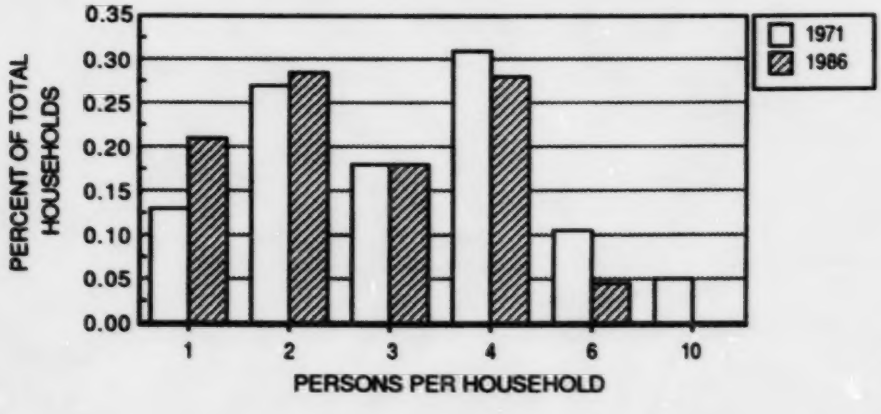

Figure 13/ Household Size Distributions in the Toronto CMA in 1971 and 1986

2.4/ Changes in Labour Force by Occupation Group and Industry Type

Figure 14 illustrates the changes in the distribution of labour force by occupation group between 1971 and 1986. The diagram shows the increase in the proportion of managerial, administrative, and professional occupation groups and the decline in the proportion of process and fabrication occupation groups. The diagram also shows that the proportions of clerical, sales, and service workers have remained virtually unchanged during the 15-year period.

The changes in the composition of the labour force by occupation group have been driven by the changes in the composition of jobs by industry type. Figure 15 shows the changes in labour force by industry type and illustrates the decline in the proportion of manufacturing employment. The diagram illustrates that the principal growth sector during the 15-year period has been the employment in business services followed by the growth in consumer services.

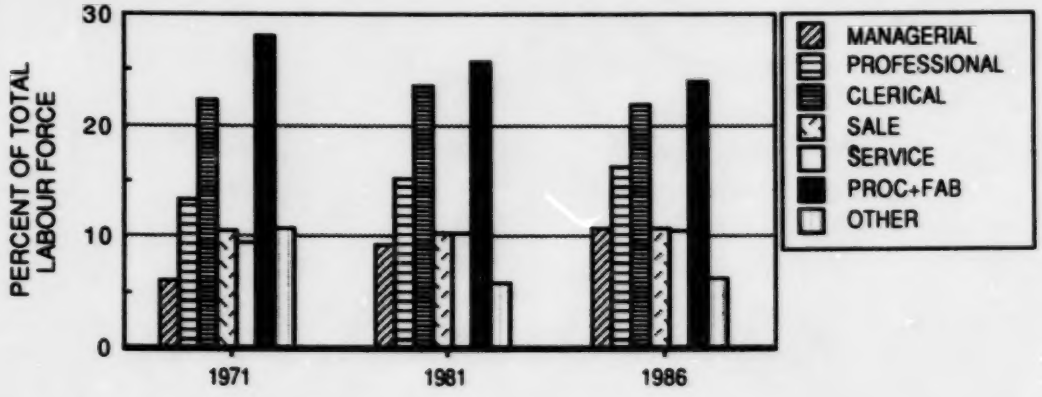

Figure 14/ Composition of Labour Force by Occupation Group

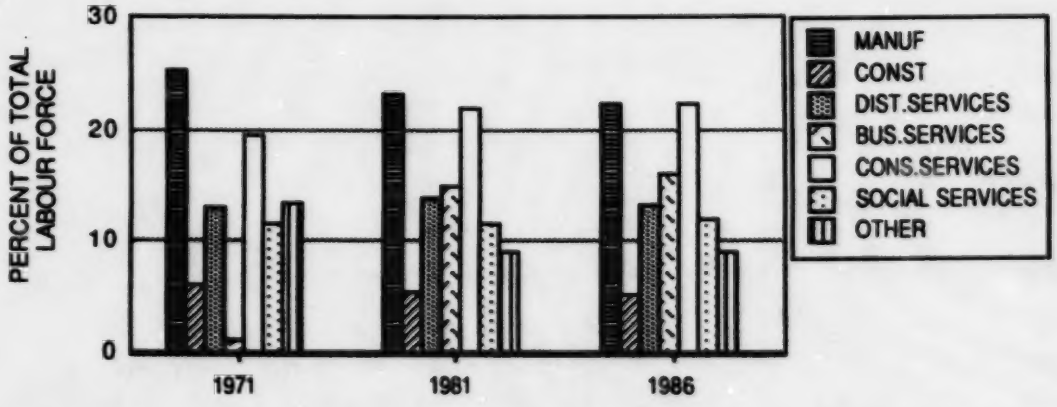

Figure 15/ Composition of Labour Force by Industry Type

2.5/ Changes in Travel Flows

Figures 16 and 17 provide a very general view of the person trips across two of the key cordon lines in Metropolitan Toronto (Metropolitan Toronto Planning Department, 1990). Figure 16 shows the morning peak period inbound passenger flows across the Metropolitan Toronto boundary by major direction. The diagram illustrates that flows across the western Metro boundary increased sharply between 1977 and 1981, levelled off between 1981 and 1983 and then resumed steady growth. Figure 16 also shows that travel across the northern boundary has grown at the fastest rate since 1983, reflecting the rapid development of York Region. Flows across the eastern boundary have exhibited steady growth since 1979.

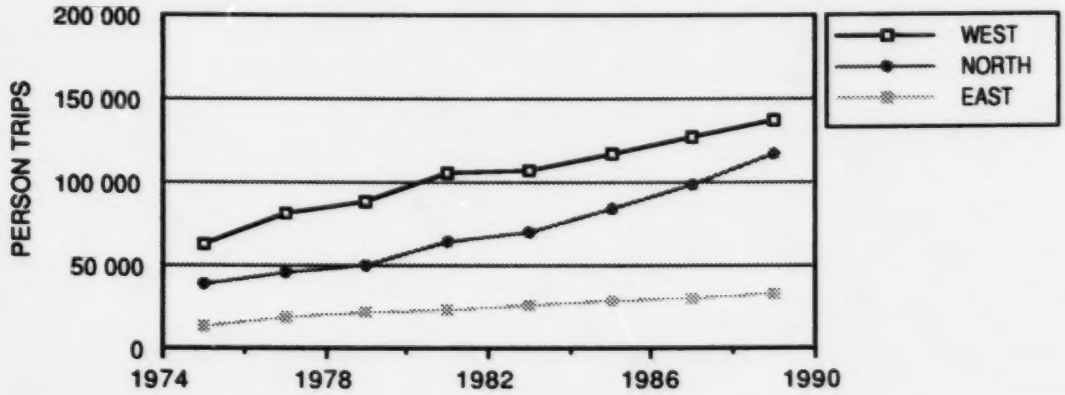

Figure 16/ Passenger Volumes Crossing Metro Boundary Cordon Inbound 06:30-09:30

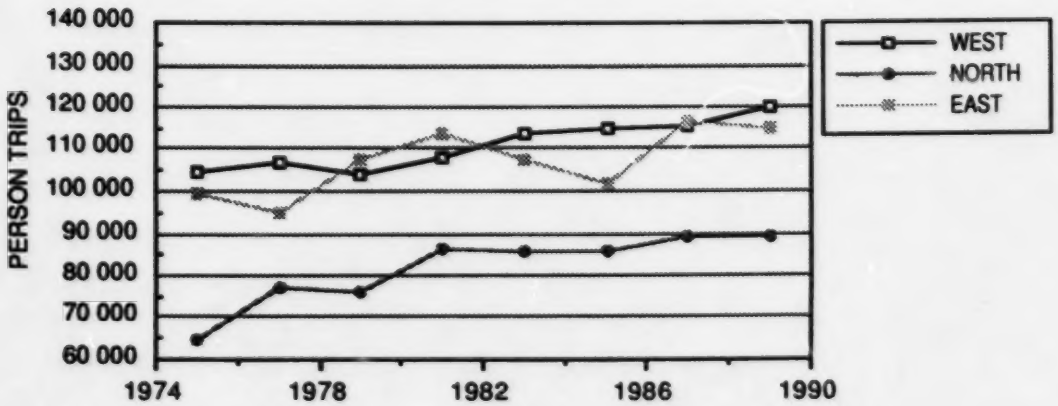

Figure 17/ Passenger Volumes Crossing Central Cordon Inbound 06:30-09:30

Figure 17 illustrates the passenger volumes crossing the central cordon around the central business district. Passenger flows from the western sector of the GTA increased sharply between 1979 and 1983, levelled off and then resumed growth in 1989. Passenger flows across the northern boundary increased sharply between 1977 and 1981, decreased between 1981 and 1985 and then increased again. These variations may reflect the uncertainties associated with short-term counts, the recession between 1981 and 1983, and the sustained expansion of the economy between 1983 and early 1990.

Figure 18 shows the percentage of trips by mode crossing the central cordon. The diagram illustrates that the share of passenger flows on the Toronto Transit Commission (TTC) have been relatively stable, while those on GO Transit have increased steadily. The share of passengers travelling by automobile has declined by about 5% since 1975.

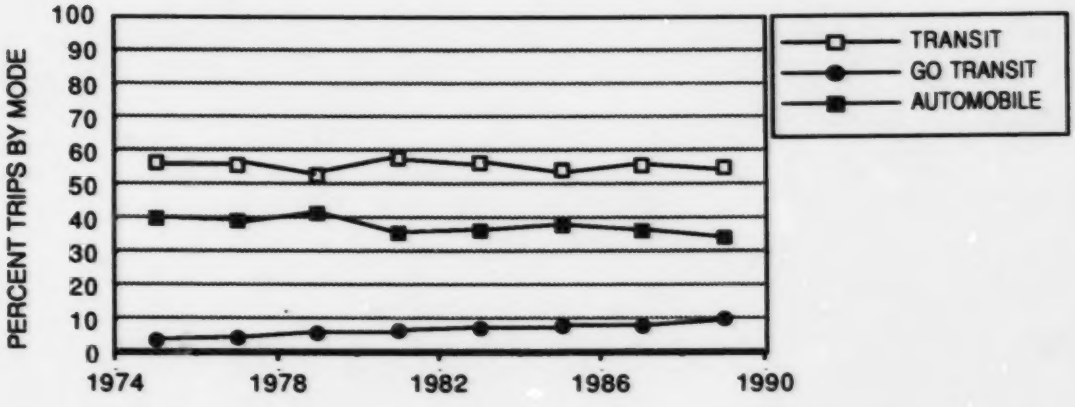

Figure 18/ Percent Trips by Mode Across Central Area Cordon 07:00-10:00

3/ SPATIAL STRUCTURE OF THE GTA AND COMMUTING IN 1986

3.1/ The Regional Context

Figure 19 illustrates the regional context of the GTA and shows the spatial distribution of resident labour force and employment by major sub-area, where Metropolitan Toronto has been subdivided into four major sub-areas. The diagram illustrates the extent of the imbalances in resident labour force and employment at the regional scale. For example, the massive deficit in resident labour force in PD#1, the excess of resident labour force in Scarborough and in many of the outer municipalities. It may be noted that in 1986 Metropolitan Toronto had a resident labour force of 1 260 000 and an employment of 1 345 000, a difference that had to be overcome through commuting across the border of Metropolitan Toronto. The trends in cross Metro border commuting were illustrated in Chapter 2. This chapter provides a more detailed view of this cross-border commuting from the regional municipalities adjacent to Metropolitan Toronto and from the municipalities outside of the GTA.

Figure 20 illustrates the commuting linkages produced by labour force resident in the areas external to the GTA to jobs within the GTA. The largest external linkages are along the the QEW corridor from Niagara Region to Hamilton, from Simcoe into Metropolitan Toronto, and from Simcoe into York Region. The diagram also illustrates that there are important commuting linkages along the Highway 401 corridor from Wellington and Waterloo in the west and from Northumberland in the east.

Table 3 summarizes the resident labour force, the labour force attracted to jobs within the GTA, and the rate of production of external commuting linkages from the regional municipalities adjacent to the GTA in 1986. The fourth column shows that the production rate per 1000 decreases sharply as travel distance to jobs in the GTA increases. For example, the rate is 103 per 1000 resident labour force from Wellington and only 25 per 1000 from Waterloo.

Table 3/ Production of External Commuting Linkages from Adjacent Municipalities in 1986

External Zone	Labour Force	External Linkages	Production Rate/1000
Niagara	171 800	9 800	57
Waterloo	171 100	4 200	25
Wellington	70 700	7 300	103
Dufferin	16 350	4 870	298
Simcoe	113 400	16 600	147
Northumberland	30 850	2 960	96

3.2/ Spatial Distributions of Labour Force and Employment

Figure 21 illustrates the spatial distributions of resident labour force and employment observed at the municipal level within the GTA in the 1986 census. The diagram illustrates the strong concentrations of labour force living in the inner planning districts of Metropolitan Toronto, in the northeastern sector running out through Scarborough to Markham, and in the western sector through Etobicoke to Mississauga.

Figure 21 shows that the total resident labour force and total employment are roughly in balance in many of the planning districts and municipalities. The most important exception is the Toronto central area where the labour force resident in PD#1 in 1986 was 80 500 while the employment was 414 500.

Inspection of the municipalities to the west of Metropolitan Toronto shows that there is a surplus of resident labour force in Brampton, to a lesser extent in Mississauga, and in Oakville and Burlington. Employment is greater than resident labour force in Vaughan, labour force is in surplus along the Yonge Street axis within York Region, and resident labour force and employment are balanced in Markham. Resident labour force exceeds employment in the municipalities to the east.

Figure 22 shows a detailed view of the distributions of resident labour force and employment within Metropolitan Toronto in 1986. Inspection of the three planning districts along the Yonge Street corridor shows that resident labour force changes from a massive deficit in PD#1 to a surplus in PD#11. Resident labour force exceeds employment in the inner residential area in central Etobicoke and in the northeastern sections of Metropolitan Toronto, while employment exceeds resident labour force in the northwestern sectors of Metropolitan Toronto.

3.3/ Commuting to Employment in PD#1

Figure 23 illustrates the commuting linkages to jobs in PD#1 in 1986, where the upper diagram shows the linkages from residential areas outside of Metropolitan Toronto and the lower diagram the linkages attracted to PD#1 from residential zones inside Metropolitan Toronto.

Some of the important features illustrated by Figure 23 are:

A/ the large number of intra-zonal trips within PD#1,
B/ the important flows from the residential areas within Metropolitan Toronto,
C/ the strong linkages from Markham, Brampton, and Oakville, and
D/ the long distance commuting linkages along the Lakeshore and Yonge Street corridors.

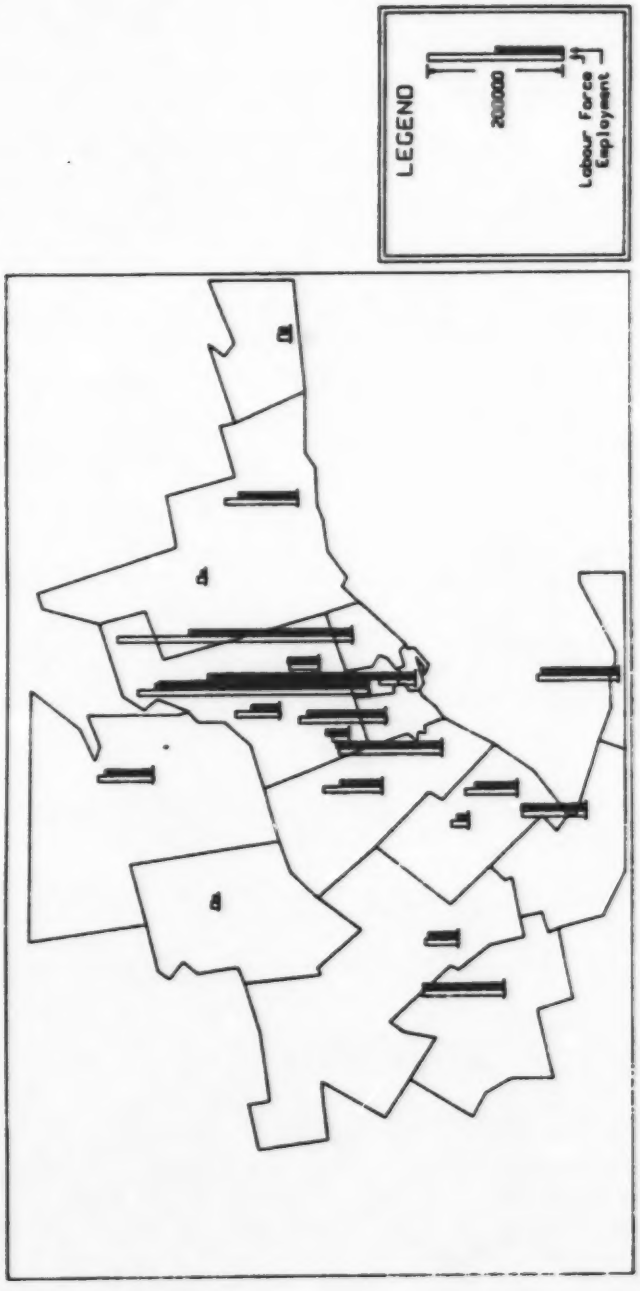

Figure 19/ Regional Setting of the Greater Toronto Area

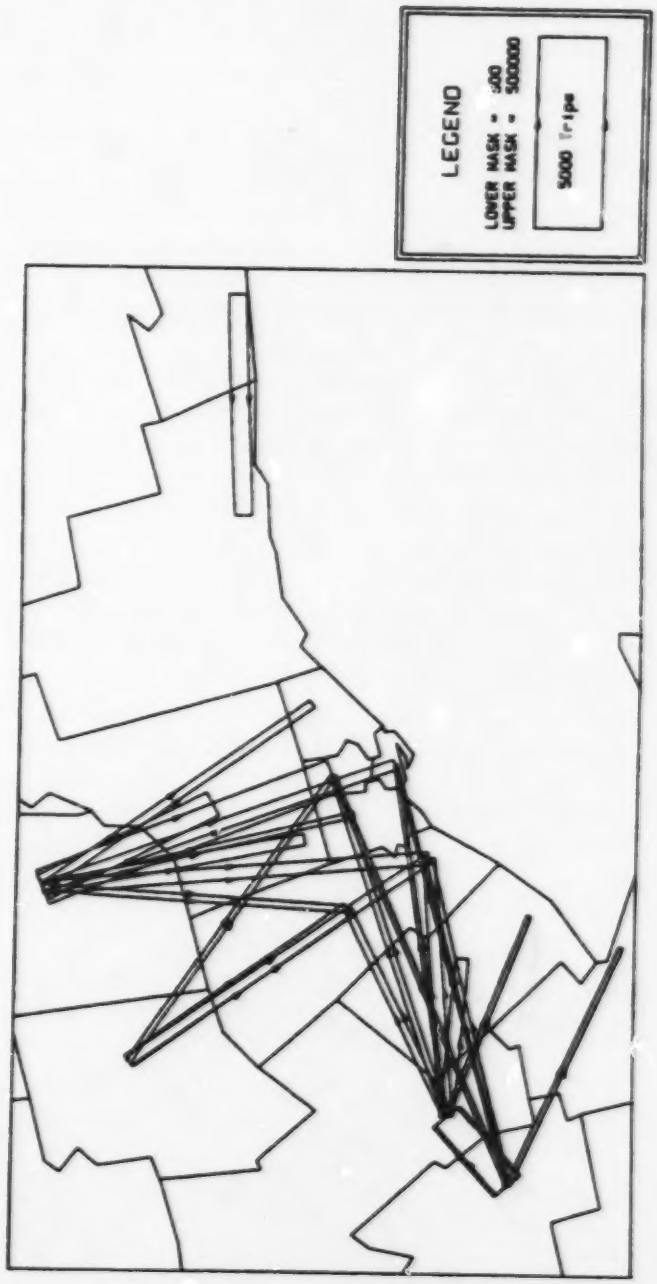

Figure 20/ External Commuting Linkages to the GTA in 1986

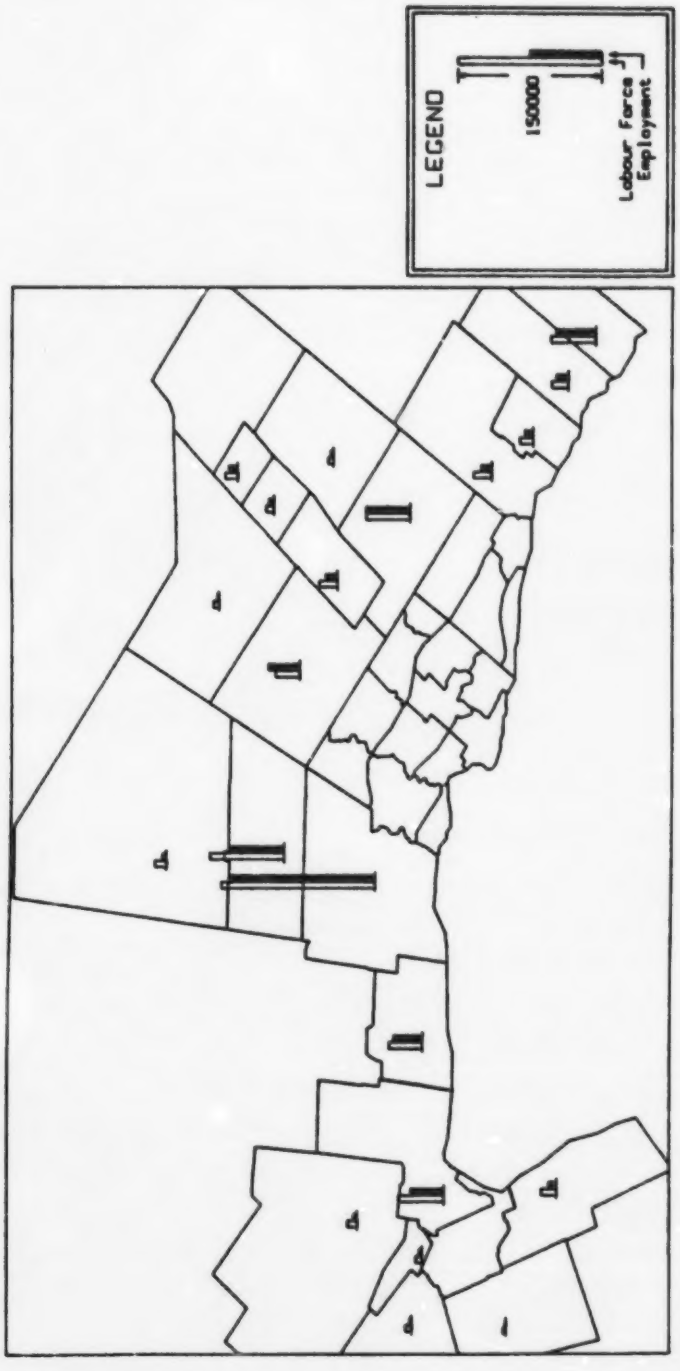

Figure 21/ Distribution of Labour Force and Employment within the GTA in 1986

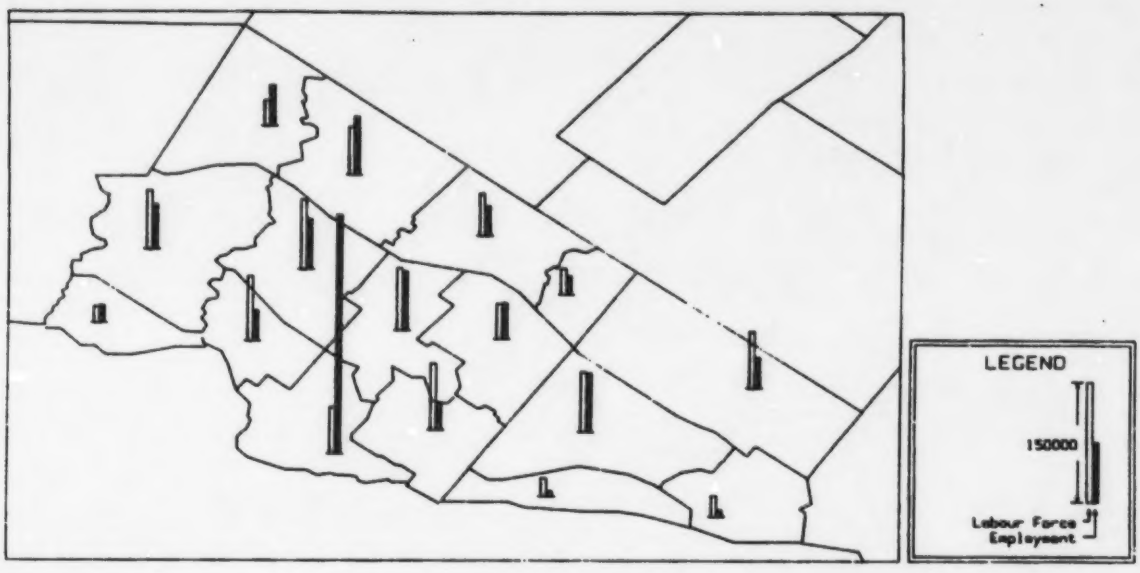

Figure 22/ Distribution of Resident Labour Force and Employment in Metropolitan Toronto in 1986

The relatively large number of intra-zonal trips within PD#1 reflects the efforts by the City of Toronto to increase the supply of housing units within the central area.

Chapter 4 shows that the increase in resident labour force between 1981 and 1986 was a very important component of the development changes in that five-year period.

This is an important change from a transportation demand perspective since a significant percentage of these trips are by foot or bicycle. The 1986 TTS showed the following transportation mode choice behaviour for intra-zonal commuting linkages within PD#1:

transit	57%
auto driver + passenger	29%
walk + cycle	15%

The inset to Figure 23 shows that strong commuting linkages existed between each of the residential zones within Metropolitan Toronto and jobs in PD#1. The rates of participation in employment in PD#1 are summarized in Table 4.

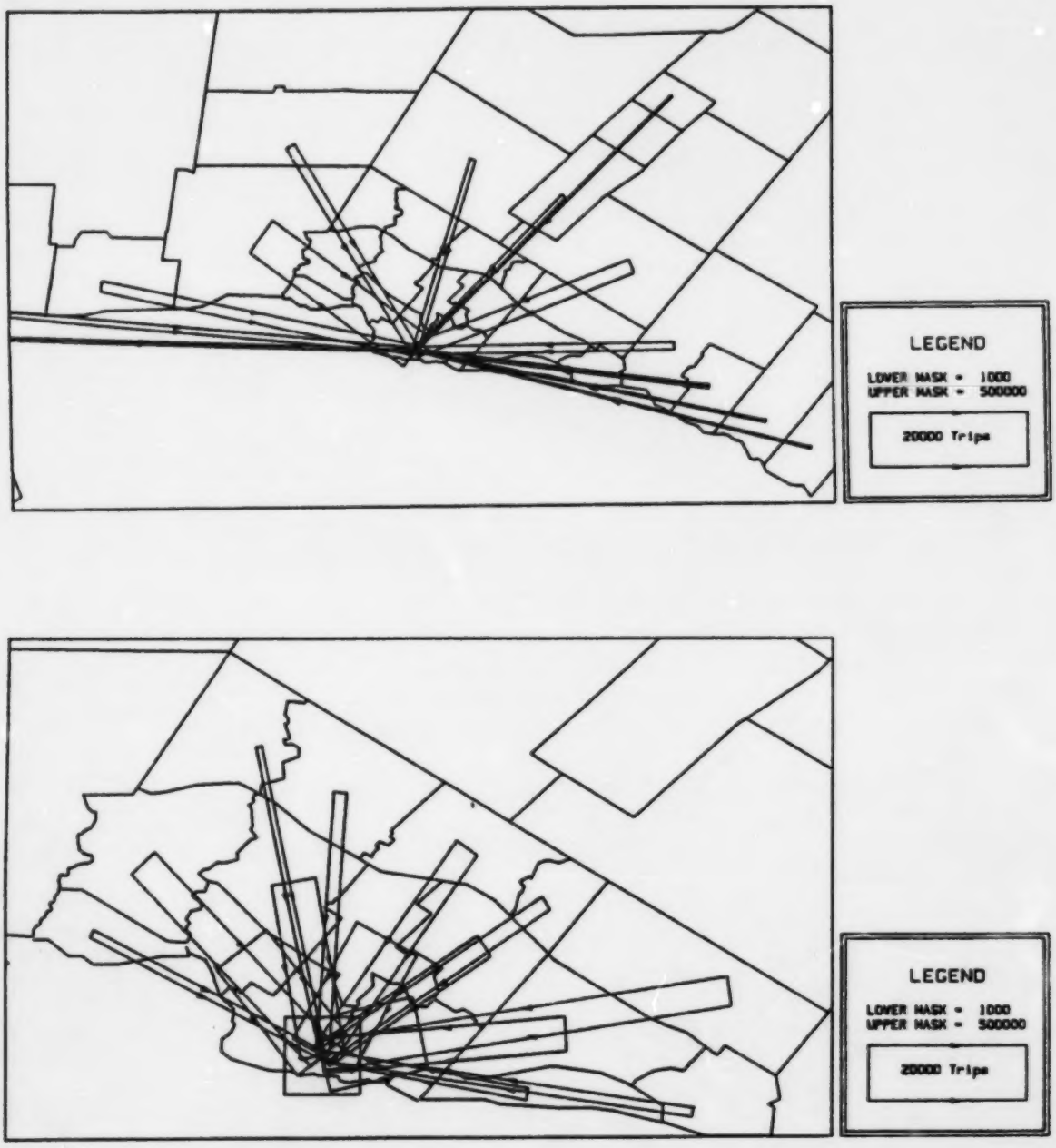

Figure 23/ Commuting Linkages to Jobs in PD#1 in 1986

Table 4/ Rate of Labour Force Participation in PD#1 Jobs in 1986

Planning District	Labour Force	No. PD#1 Linkages	Rate per 1000 LF
1	75 200	48 600	647
2	106 200	40 400	380
3	115 000	28 750	250
4	106 000	43 850	414
5	60 300	15 500	257
6	110 500	45 500	412
7	28 100	5 000	177
8	97 700	20 100	206
9	42 200	4 100	97
10	79 200	8 300	105
11	70 600	16 000	226
12	44 600	9 500	212
13	99 000	21 000	212
14	30 800	8 000	258
15	34 950	6 300	179
16	96 400	18 400	191

Inspection of the rates of participation in PD#1 labour force shows that the rate decreases from 647 per 1000 for the labour force resident in PD#1, through 400 per 1000 in the PDs adjacent to PD#1 to a low of about 100 per 1000 in PDs #9 and #10 in northwestern Metropolitan Toronto. The rates for the northeastern corner of Metropolitan Toronto are about 200 per 1000. Clearly, these participation rates are a function of the transportation accessibility to PD#1, the occupation status of the resident labour force, and the trade-off between the consumption of residential space (apartments versus detached dwelling units) and commuting distance.

The commuting linkages to jobs in PD#1 from residential areas outside of Metropolitan Toronto are illustrated by Figure 23. The largest flows are from Mississauga, Markham, and Brampton. The longer distance commuting flows along the Lakeshore corridor are also illustrated. The larger participation rates from residential areas outside of Metropolitan Toronto are 163 per 1000 from Pickering, 144 per 1000 from Markham, 135 per 1000 from Oakville, and 128 per 1000 from Ajax.

3.4/ Commuting to Other Yonge Street Employment Centres

Figure 24 illustrates the commutersheds of the two other employment centres along the Yonge Street corridor, PD#4 (containing the Eglinton and St. Clair office concentrations) and PD#11 (north Yonge area north of Highway 401). Both centres have similar commutershed structures with significant intra-zonal commuting and significant amounts of labour force attracted from adjacent planning districts.

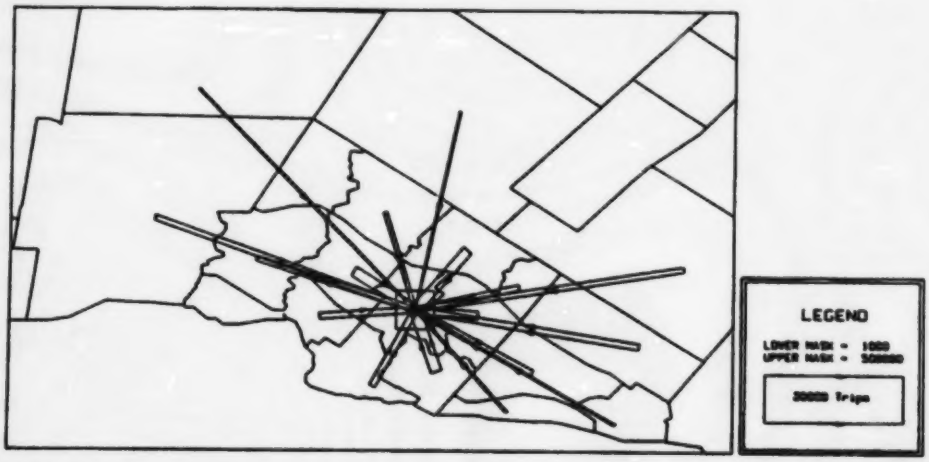

Figure 24/ Commutersheds of Employment in PDs #4 and #11 in 1986

3.5/ The Western Sector Commuting Sub-Area

Commuting in the western sector of the GTA is the most important suburban commuting sub-area because of the large number of jobs located in Mississauga. Employment in Mississauga in 1986 was 202 000 versus 415 000 in PD#[illegible] Table 5 summarizes the resident labour force and employment in the western sector of the Toronto CMA in 1986. The table shows that there is a resident labour force surplus of about 53 000 in the sub-area, which means that significant commuting has to occur from the sub-area. It is shown later in this chapter that the out-commuting is higher than this because of significant commuting into the area, particularly to jobs in the very large industrial area immediately to the west of Pearson International Airport.

Table 5/ Resident Labour Force and Employment in the Western Sector by Municipality in 1986

Municipality	Labour Force	Employment	Labour Force Surplus
Brampton	101 900	72 400	29 500
Mississauga	207 100	202 000	5 100
Oakville	46 000	40 700	5 300
Burlington	61 300	48 000	13 300
TOTAL	416 300	363 100	53 200

Figure 25 illustrates the distribution of resident labour force and employment at a more detailed spatial scale. The diagram clearly illustrates the resident labour force surpluses that exist in all zones of the sub-area other than the industrial area adjacent to Pearson International Airport.

Figure 25/ Resident Labour Force and Employment Distributions for Western Sub-Area in 1986

Two distinct commuting submarkets are generated by the labour force resident in this sub-area and these are the travel to jobs in PD#1 (with about half of the trips by public transportation) and travel to more local jobs (dominated by automobile travel). Figure 26 shows the travel from the western sector of the GTA to jobs in PD#1. The largest flows are from zone 35D in the eastern part of Mississauga, although most zones generate significant volumes of commuting trips to PD#1.

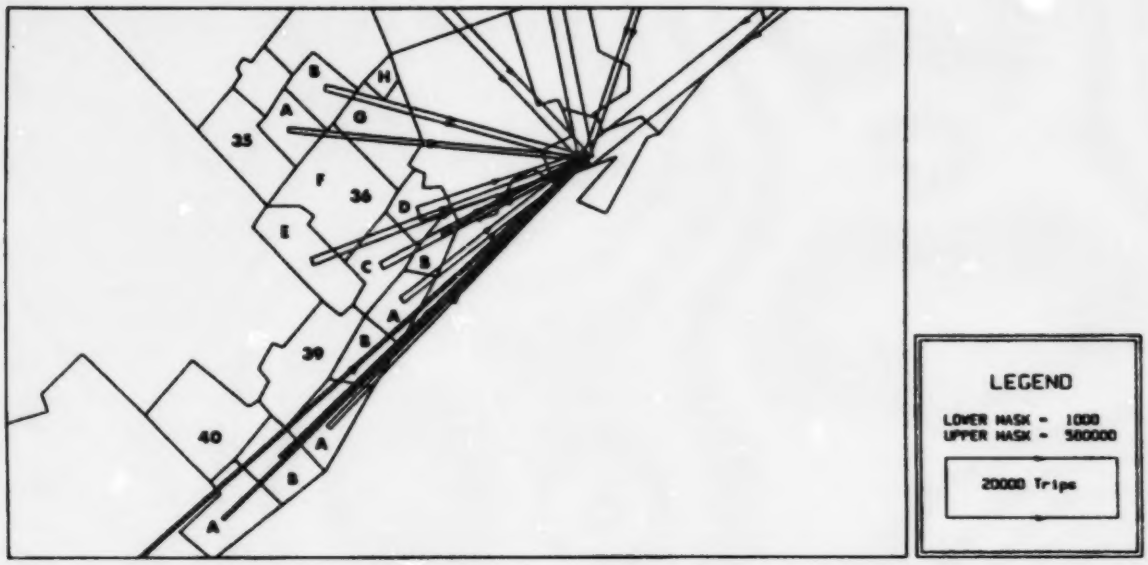

Figure 26/ Commuting Trips to PD#1 Produced by Residential Areas in the Western Sector in 1986

Table 6 summarizes the rates of production of trips to jobs in PD#1 in 1986. The table shows that the participation rates in PD#1 employment are high in the Mississauga zones along the Lakeshore (A and B), in Meadowvale West (F), and in Oakville.

Figure 27 illustrates the principal commuting linkages to the three major employment centres in Mississauga. The diagram illustrates that each of the three zones attracts much of the labour force from residential areas within Mississauga and from labour force resident in Etobicoke. The reverse commuting from Etobicoke was an effect noted in the analysis of the 1981 census place of work data. Home to work linkages data, stratified by both occupation group and industry type, were available and this information showed that much of the reverse commuting was asscoiated with the blue collar occupation groups. Unfortunately, similar data was not available for 1986.

Table 6/ Commuting Trips to PD#1 Produced by Residential Areas in the Western Sector in 1986

Residential Area	Labour Force	External Linkages	Production Rate/1000
Brampton			
35A	37 200	2100	56
35B	53 300	3100	59
Mississauga			
36A	24 400	4000	164
36B	17 500	2500	141
36C	34 800	4400	128
36D	67 800	8400	124
36E	41 900	4400	104
36F	2 500	400	156
36G	900	10	12
36H	17 300	900	52
Oakville			
39A	23 800	2800	116
39B	20 100	3300	166
Burlington			
40A	32 700	1500	47
40B	26 600	1600	58

Figure 27/ Commutersheds of Mississauga Employment Centres in 1986

3.6/ The Northeastern Metro Fringe Commuting Sub-Area

Figure 28 illustrates the spatial distribution of labour force and employment in the eastern part of Metropolitan Toronto and along the northern boundary of Metropolitan Toronto. The diagram illustrates the labour force surpluses that existed in PD#16 in Scarborough and in the eastern half of Markham.

Figure 29 illustrates the commuting patterns generated by labour force resident in PD#16 in Scarborough and in Markham. The diagram shows the strong linkages that exist with jobs in PD#1, particularly from the sub-areas of PD#16. The second feature of the commuting patterns from these residential areas is the commuting to jobs along the Highway 401 corridor in both Scarborough and North York.

3.7/ Eastern Sector Commuting Sub-Area

Figure 30 illustrates the distribution of resident labour force and employment in the eastern sector of the GTA in 1986. The diagram shows that resident labour force surpluses exist in each of the zones, except the southeastern corner of Oshawa which contains the automobile manufacturing industries.

Figure 28/ Labour Force and Employment Distributions in the Northeast in 1986

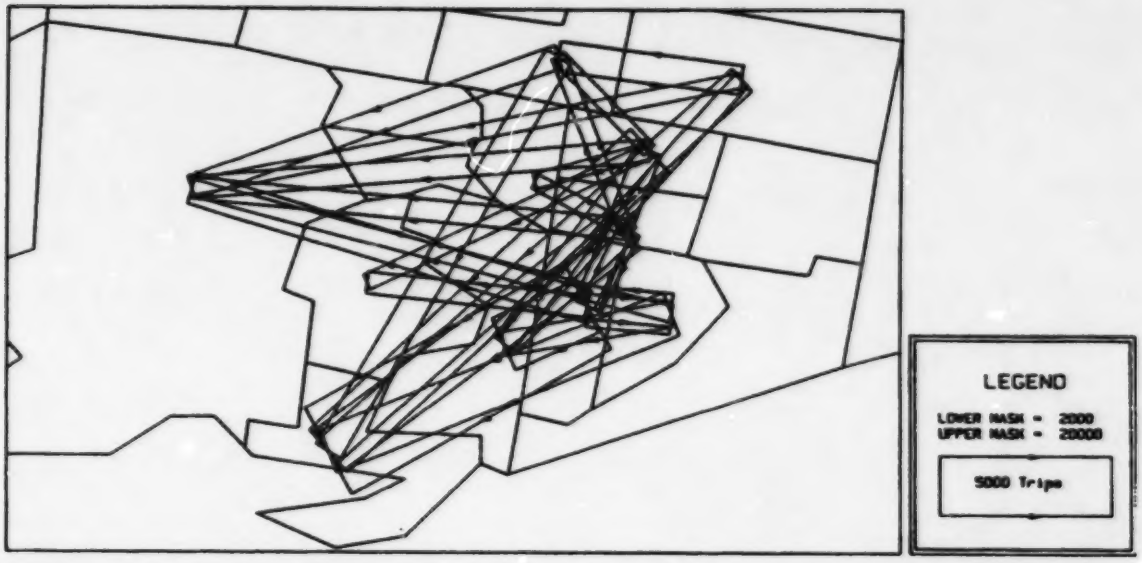

Figure 29/ Commutersheds Produced by Labour Force in the Northeast in 1986

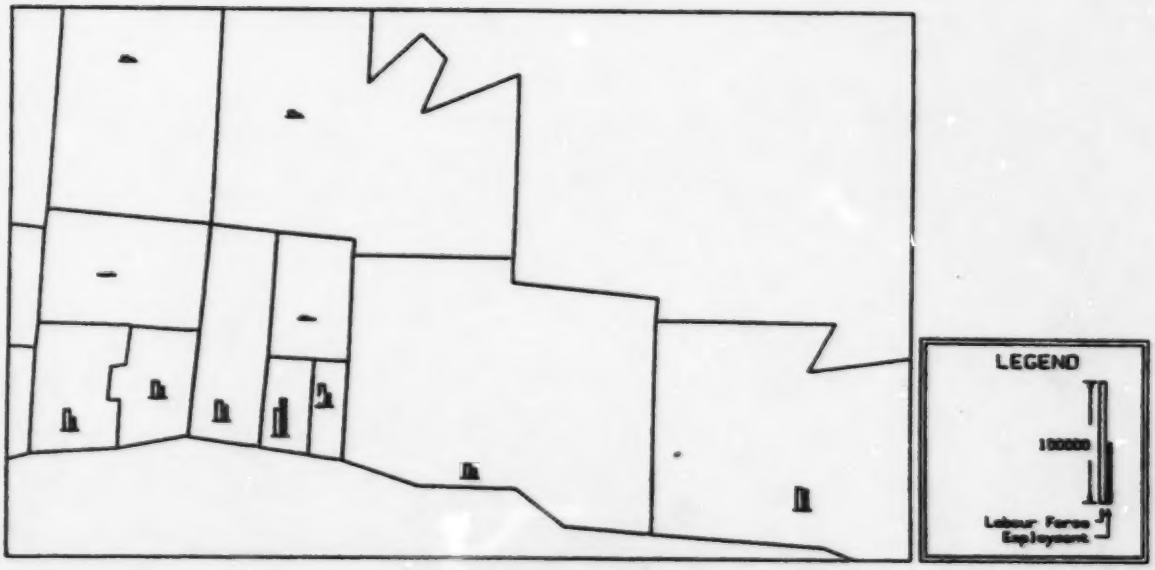

Figure 30/ Labour Force and Employment Distributions in the Eastern Sector in 1986

Table 7 summarizes the labour force and employment in each of the zones of the eastern sector and indicates the labour force surpluses and deficits in 1986. The table indicates that the eastern sector has a labour force deficit of about 35 000 which means that significant out-commuting is required to satisfy the labour force surplus.

Table 7/ Resident Labour Force and Employment in the Eastern Sector in 1986

Municipality	Labour Force	Employment	Labour Force Surplus	Rate of Participation in PD #1 Jobs/1000 LF
Pickering	26 800	16 500	10 300	163
Ajax	19 800	13 700	6 100	126
Whitby	23 600	18 500	5 100	76
Oshawa	62 000	63 400	(1 400)	28
Newcastle	16 600	14 300	2 300	15
Northumberland	30 900	25 700	5 200	7
Remainder	17 900	10 900	7 000	34
TOTAL	197 600	163 000	34 600	58

4/ CHANGES IN SPATIAL STRUCTURE AND COMMUTING IN THE GTA BETWEEN 1981 AND 1986

The earlier chapters of this report discussed changes in some of the overall characteristics of the region as well as its spatial characteristics and commuting structure in 1986. The purpose of this chapter is to describe the changes in the spatial structure of the GTA that occurred between 1981 and 1986 and commuting changes.

4.1/ Changes in Labour Force and Employment

Figure 31 illustrates the changes in labour force and employment that occurred between 1981 and 1986. The major labour force changes within Metropolitan Toronto have been in PD#1 (15 000) and in PD#16 (25 000). Outside Metropolitan Toronto, the major increases occurred in Markham (#31), Vaughan (#33), Brampton (#35), and Mississauga (#36).

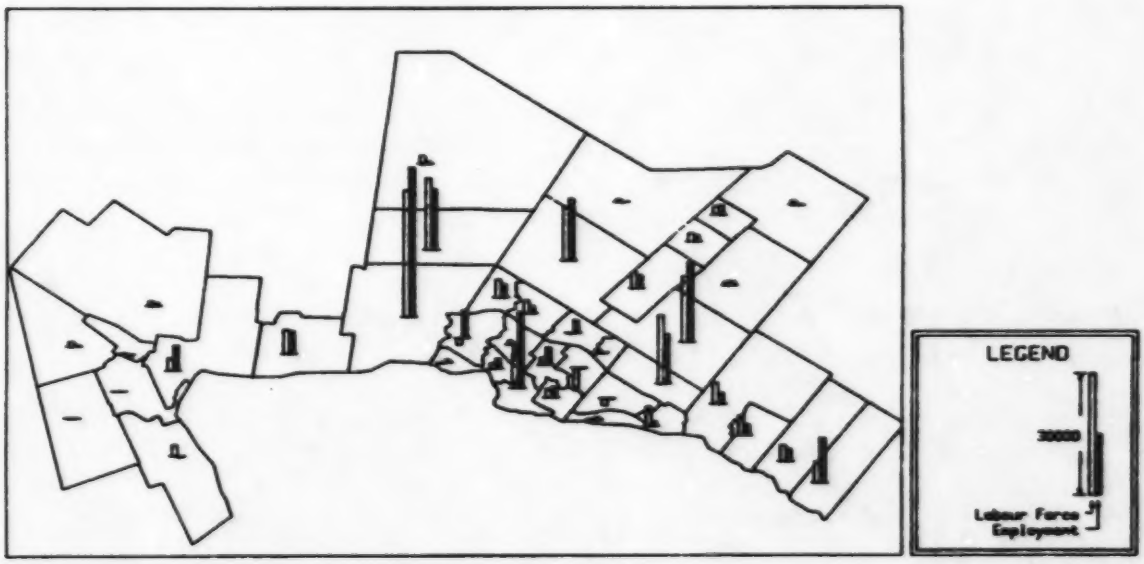

Figure 31/ Changes in Labour Force and Employment 1981-1986

The principal increases in employment between 1981 and 1986 were in PD#1, PD#16, Oshawa (#23), Markham (#31), Vaughan (#33), Brampton (#35), and Mississauga (#36). It is important to note that the employment increase in Mississauga was almost double that which occurred in PD#1. It is also important to note that the increase in employment in York Region was almost twice the increase in PD#1.

The following sections identify the major factors underlying the changes in labour force growth. Little analysis of employment growth is possible since employment data were not available by industry type in the 1986 census information.

4.2/ Determinants of Labour Force Change

It is well known that the labour force participation rate varies across the GTA, where the differences are due primarily to differences in female labour force participation rates. Participation rates are higher for the younger age groups and for the smaller household sizes because of the smaller number of children. The household size distributions are strongly influenced by the housing supply characteristics (e.g., single family units versus apartments) and vice-versa. This idea was discussed in connection with the conceptual framework illustrated in Figure 1.

4.2.1/ Housing Supply

The changes in housing supply by dwelling unit type (DU) between 1981 and 1986 are illustrated in Figure 32. The diagram shows that there was little increase in the supply of single family dwelling units within Metropolitan Toronto except in PDs #15 and #16 in Scarborough. The bulk of the increase in supply of single family units occurred in York (#31 and #33) and Peel (#35 and #36) Regions.

The central section of Figure 32 illustrates that most of the increase in apartments (greater than five floors) occurred within Metropolitan Toronto but significant increases occurred in Brampton (#35) and Peel (#36). The important feature within Metropolitan Toronto was the increase in supply of almost 15 000 units within PD#1.

The lower section of Figure 32 shows that the increase in other dwelling unit types (apartments less than five floors, town houses) occurred mainly within Metropolitan Toronto (PDs #2, #6, #10, and #16), Oshawa (#23), and Mississauga (#36).

These changes in housing supply stratified by housing type have important impacts on the household structure of an area. There is a strong correlation between age of household head and household size. Table 8 shows the relationship between housing type and household head age observed in the 1981 census.

Table 8/ Household Head Age versus Housing Type in 1981

Housing Type	Household Head Age			
	15-24	25-44	45-64	65+
Detached DU	0.125	0.387	0.559	0.427
Other	0.111	0.223	0.164	0.091
Apartment	0.764	0.389	0.277	0.482

The table entries indicate very clearly that households with younger household heads (and therefore, smaller households) are concentrated in apartments. The proportion of households in apartments decreases with increasing household head age and then increases for the 65+ age group.

Figure 33 illustrates the changes in households by household size. The diagram illustrates that the growth in one- and two-person households was concentrated within Metropolitan Toronto and in Mississauga. Most of the growth in the larger household sizes occurred in the residential areas outside Metropolitan Toronto, except for the northeastern corner of Scarborough.

4.2.2/ Labour Force Participation

The differences in household size translate into resident labour force at different rates as indicated by the following zonal regression equation developed from the the 1986 census data (Chartier, 1990):

$$\begin{aligned}\text{Zone Labour Force} = 10.8 &+ 0.842\ (\text{1-Person Household}) \\ &+ 1.288\ (\text{2- to 3-Person Households}) \\ &+ 2.615\ (\text{4- to 5-Person Households}) \\ &+ 2.728\ (\text{6+Person Households}) \qquad (1)\end{aligned}$$

$R^2 = 0.95$

The partial regression coefficients of Equation 1 show that the gross rate of participation in the labour force decreases from about 84% in one-person households to less than 60% in the largest households.

A more direct relationship between housing type and labour force is provided by the following regression equation:

$$\begin{aligned}\text{Zone Labour Force} = 163 &+ 1.757\ (\text{Detached DUs}) \\ &+ 1.587\ (\text{Other DUs}) \\ &+ 1.140\ (\text{Apartments}) \qquad (2)\end{aligned}$$

$R^2 = 0.85$

The partial regression coefficients reflect the characteristic differences in household size associated with the different housing types and the different labour force participation rates. For example, detached DUs generate labour force at an average rate of about 1.76 per dwelling unit while apartments generate labour force at an average rate of 1.14 per dwelling unit.

4.3/ Generation of Work Trips

Chartier (1991) has developed the following zonal work trip generation equations using the TTS travel data and the census information at the 46-zone level:

WTP = daily work trips produced by a zone.

$$WTP = -873 + 0.739 \text{ (Zone Labour Force)} \quad (3)$$
$R^2 = 1.00$ standard error = 1660 trips

The following trip generation equation has been developed by forcing the regression equation through the origin:

$$WTP = 0.730 \text{ (Zone Labour Force)} \quad (4)$$
$R^2 = 1.00$ standard error = 1730 trips

The equations developed for work trip attractions (WTA) are:

$$WTA = -1787 + 0.804 \text{ (Zone Employment)} \quad (5)$$
$R^2 = 1.00$ standard error = 3429 trips

$$WTA = 0.792 \text{ (Zone Employment)} \quad (6)$$
$R^2 = 1.00$ standard error = 3680 trips

These equations may be compared with those developed by Miller et al (1990) from zonal regression analyses of the TTS data at a much finer scale:

$$WTP_m = -4.1 + 0.779 (FTLF_m) + 0.345 (PTLF_m) \quad (7)$$
$R^2 = 0.99$

$$WTP_f = -6.1 + 0.801 (FTLF_f) + 0.387 (PTLF_f) \quad (8)$$
$R^2 = 0.99$

$$WTA = -10.3 + 0.715 \text{ (Zone Employment)} \quad (9)$$
$R^2 = 0.88$

where WTP_m and WTP_f = the daily work trips produced by males and females, respectively, FTLF and PTLF = the full-time and part-time labour force, respectively, with the subscripts identifying males and females, and WTA = the daily work trips attracted.

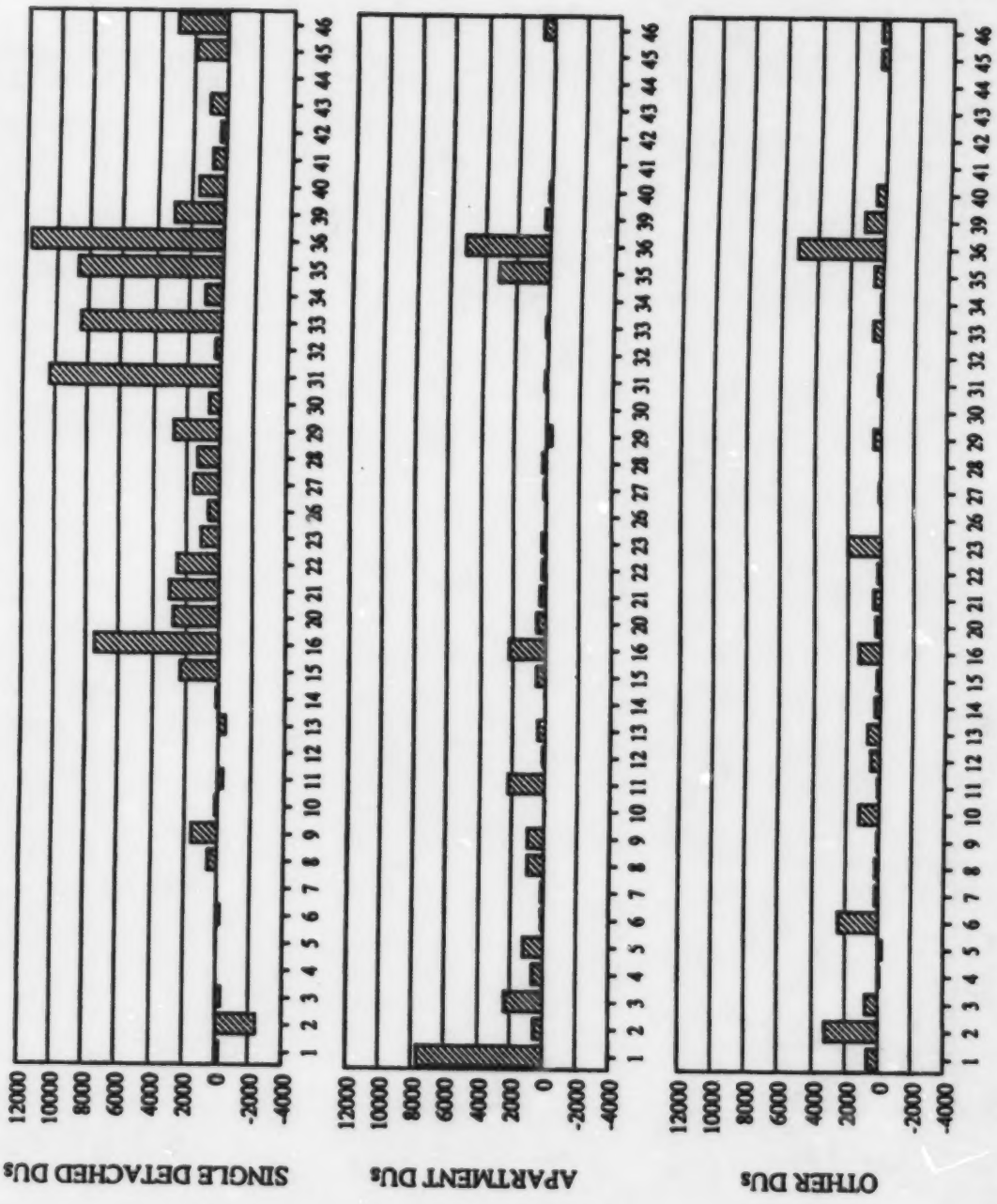

Figure 32/ Changes in Housing Supply by Dwelling Unit Type, 1981-1986

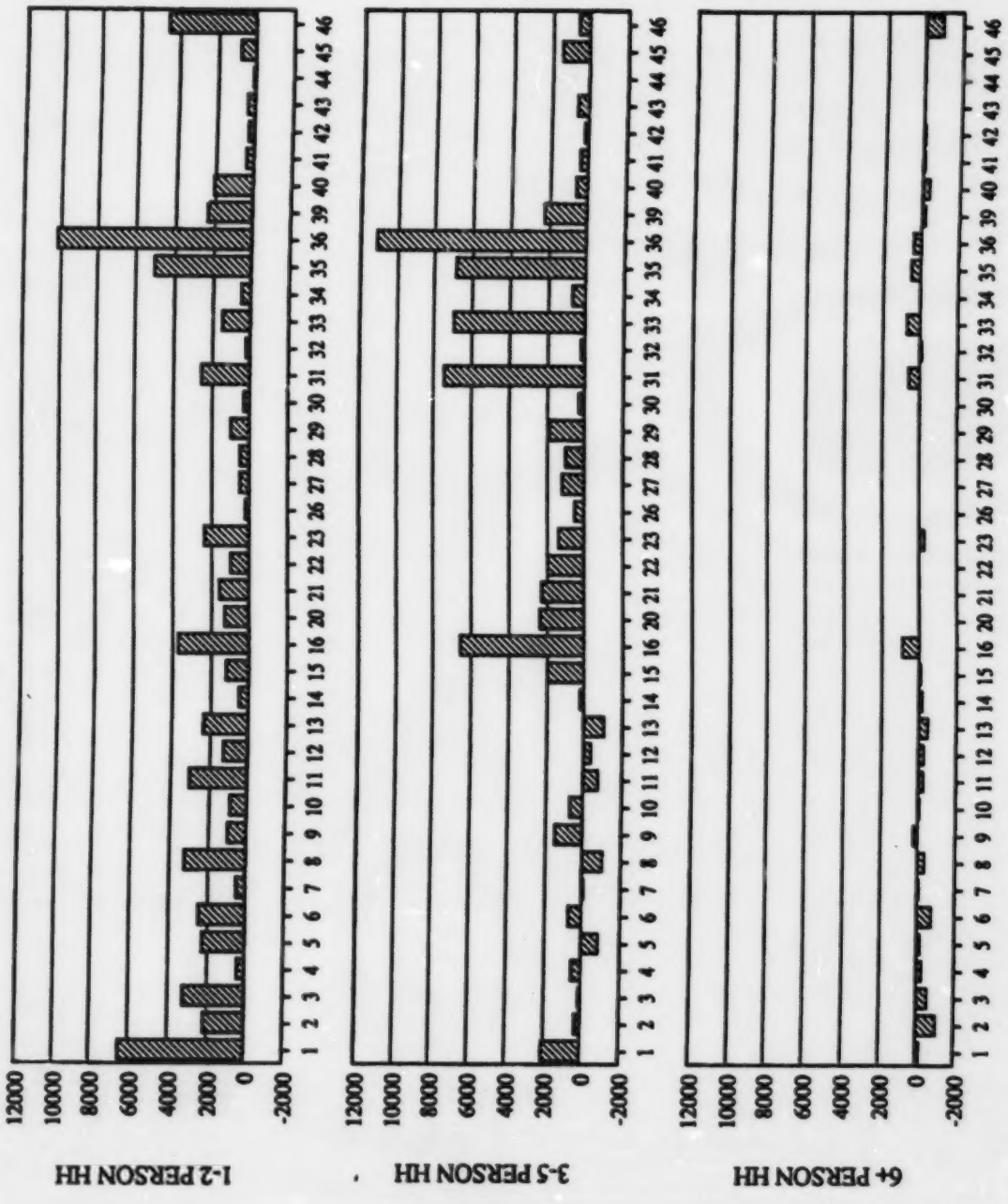

Figure 33/ Changes in Households by Household Size, 1981-1986

4.4/ Changes in Cross-GTA Border Inbound Commuting

Table 9 summarizes the changes in linkages produced by external zones that are attracted to jobs within the GTA, where the destinations are separated by outside Metro and within Metro. The data need to be interpreted with caution since the results are based on samples of a relatively small effect and the basis for reporting the data changed a little between 1981 and 1986. The table entries indicate that the major sources of additional inbound commuting across the GTA boundary were Wellington and Simcoe, particularly in terms of commuting to jobs outside Metropolitan Toronto.

Table 9/ Changes in Cross-GTA Border Inbound Commuting Between 1981 and 1986

Origin of Labour Force	Linkages to Jobs Outside Metro			Linkages to Metro Jobs		
	1981	1986	Change	1981	1986	Change
Niagara	1070	1586	516	9140	8229	-911
Waterloo	1485	1663	178	2305	2514	209
Wellington	1650	1874	224	4060	5429	1369
Dufferin	1460	1172	-280	3260	3699	439
Simcoe	7270	7973	703	6790	8636	1846
Northumberland	695	679	-16	1595	2278	683

4.5/ Major Changes in Commuting

The information presented earlier in this chapter showed that the locations of major growth in resident labour force were PD#1, PD#16, Markham, Vaughan, Brampton, and Mississauga. Major employment growth occurred in PD#1, PD#16, Oshawa, Markham, Vaughan, Brampton, and Mississauga. This section illustrates the changes in commuting associated with some of these growth areas.

4.5.1/ The PD#1 Commutershed

Figure 34 illustrates the changes in home to work linkages attracted to jobs in PD#1. Some of the major changes illustrated by the diagram include; (i) the important increase in intra-zonal commuting, (ii) the significant increases from northeastern Scarborough, Markham, and Vaughan, (iii) the relatively small increase in linkages from Mississauga (compared with the changes observed between 1971 and 1981), and (iv) the growth in long distance commuting along the Lakeshore corridor both to the east and west of the Toronto central area.

Analyses of the average network trip lengths (in kilometres) of commuters to jobs in PD#1 showed the following:

	1971	1981	1986
resident labour force	4.4	5.3	5.6
employment	10.7	13.8	14.6

The entries indicate that the average trip lengths of the labour force resident in PD#1 have increased a little over the 15-year period and this reflects the strong intra-zonal character of the commuting linkages produced by PD#1. The average trip length to jobs in PD#1 has increased substantially over the 15-year period reflecting the growth in longer distance commuting along the radial corridors focussed on PD#1. The average attraction trip length increased from 10.7 km in 1971 to 13.8 km in 1981 with the rate of increase slowing between 1981 and 1986 because of increased intra-zonal commuting.

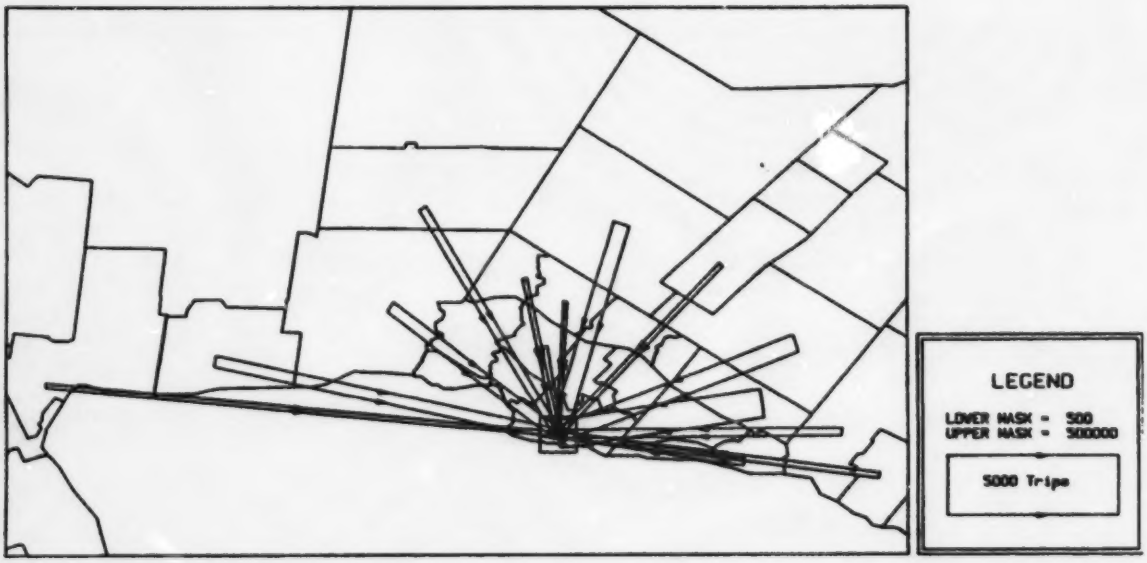

Figure 34/ Changes in the PD#1 Commutershed between 1981 and 1986

4.5.2/ Changes Within Metropolitan Toronto and York Region

Figure 35 illustrates the major increases in commuting flows produced by residential zones within Metropolitan Toronto and York Region. The largest changes were produced by the residential areas that grew significantly between 1981 and 1986. Northeastern Scarborough, Markham, and Vaughan each produced large increases in commuting to jobs in PD#1 and to jobs along the Highway 401 corridor. Clearly, the mobility opportunities provided by the centrally oriented transit system and the circumferential freeway corridors have had a strong influence on the commuting patterns that developed during the five-year period. The desire lines shown in Figure 35 also illustrate that there were significant reverse commuting flows attracted to jobs in both Markham and Vaughan. The origin to destination patterns are very diffuse reflecting the domination of these commuting linkages by automobile travel.

Analysis of the average trip lengths produced by the remaining 15 planning districts within Metropolitan Toronto have shown three types of effects: (i) increases in average trip lengths of 1-2 km from some of the inner residential areas that have undergone significant gentrification, (ii) little change in the average trip lengths produced by the intermediate residential areas, and (iii) slight reductions in the average trip lengths produced by some of the outer residential areas as local job opportunities increased.

The average trip lengths produced by residential areas in York Region have followed a pattern typical of communities on the urbanizing fringe that have undergone rapid urbanization. Mean trip lengths increased sharply during the initial stages of development as the labour force commuted to jobs within Metropolitan Toronto, often with a significant share to PD#1. The mean trip length then decreased as local job opportunities expanded from the growth in population-serving employment and eventually from basic employment. An example is provided by the following production mean trip lengths from York Region:

	1971	1981	1986
Markham	21.3	19.2	17.6
Vaughan	16.5	16.9	17.7

Markham has now matured as a local job market and the average trip length of the labour force resident in Markham decreased from 21.3 km in 1971 to 17.6 km in 1986. However, the average trip length of the labour force resident in Vaughan has continued to increase over the 15-year period and may be expected to decrease as local job opportunities expand.

4.5.3/ Changes Attracted to Jobs in Mississauga

Figure 36 illustrates the changes in commuting linkages attracted to jobs in Mississauga. The most important feature illustrated by the diagram is the massive increase in intra-zonal trips which reflects the balance between resident labour force and employment that has been achieved in Mississauga. Much of the additional commuting attracted from Brampton is also very local in nature with the focus of this attraction being the employment opportunities adjacent to Pearson International Airport in Mississauga. Jobs in Mississauga also attracted new commuters from Oakville, Burlington, and Hamilton with the QEW providing the high mobility required by these longer distance trips. The diagram also shows the reverse commuting from the western Metro suburbs, particularly Etobicoke.

Important increases in the self-containment of both Mississauga and Brampton are reflected in the following average trip length data for labour force resident in these two municipalities:

	1971	1981	1986
Mississauga	14.6	14.0	12.9
Brampton	11.0	14.3	13.3

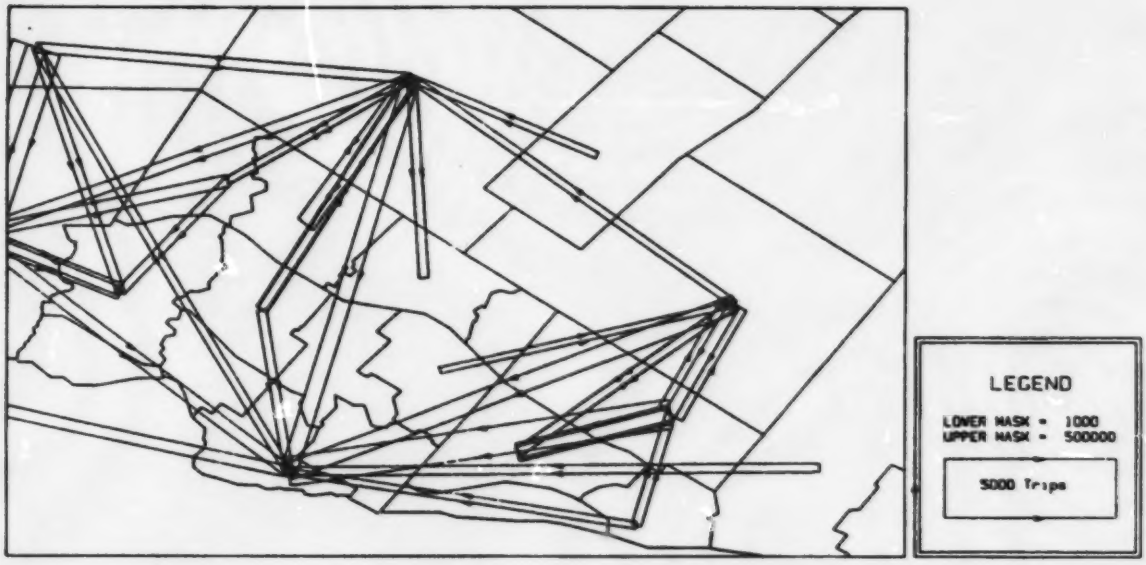

Figure 35/ Changes in Commuting Production from Metro and York Region, 1981-1986

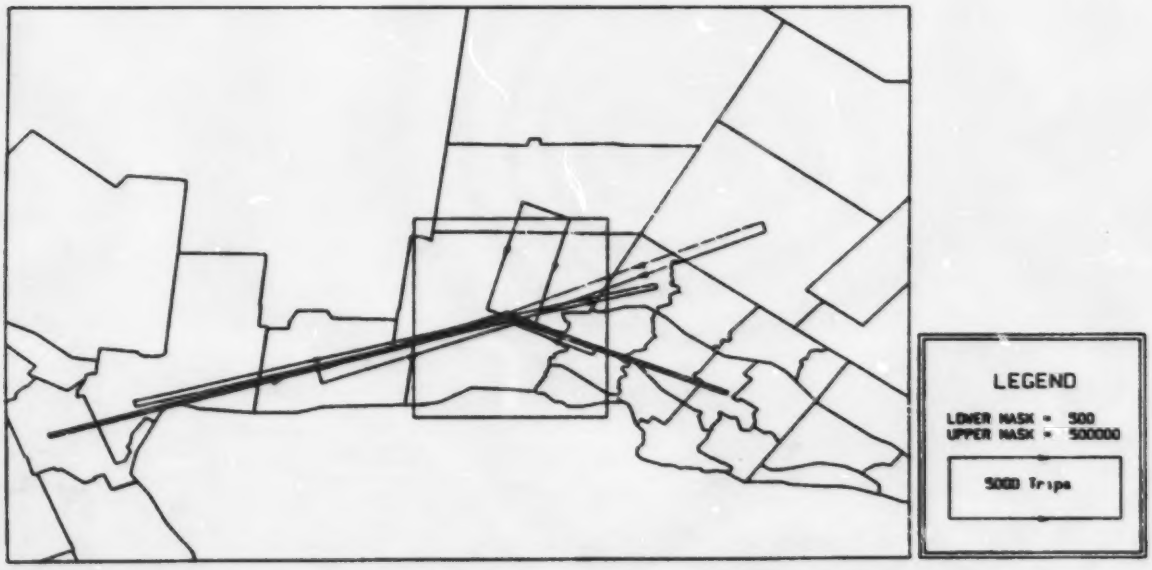

Figure 36/Changes in Commuting Attraction to Mississauga between 1981 and 1986

4.5.4/ Commuting Linkages Produced by Oakville and Burlington

Figure 37 illustrates the growth in commuting produced by Burlington and Oakville. The most important feature illustrated by this diagram is the growth in commuting along the Lakeshore corridor, where about 55% travelled to jobs in PD#1 by GO Transit in 1986. Intra-zonal travel also increased, as did commuting to jobs in Mississauga.

Inspection of the mean trip lengths of labour force resident in Oakville and Burlington shows that both municipalities have continued to generate long distance commuting demands:

	1971	1981	1986
Oakville	13.2	15.9	16.2
Burlington	10.2	15.7	15.7

The mean trip lengths for Burlington show the sharp increase that occurred between 1971 and 1981 as Burlington became part of the Toronto commutershed and its local and Hamilton commuting linkages were submerged.

4.5.5/ Changes in Commuting Produced by Durham Region

Figure 38 illustrates the changes in commuting produced by labour force resident in Durham Region. The major changes illustrated are the increases in commuting to PD#1, Scarborough, and trips which are internal to Durham Region.

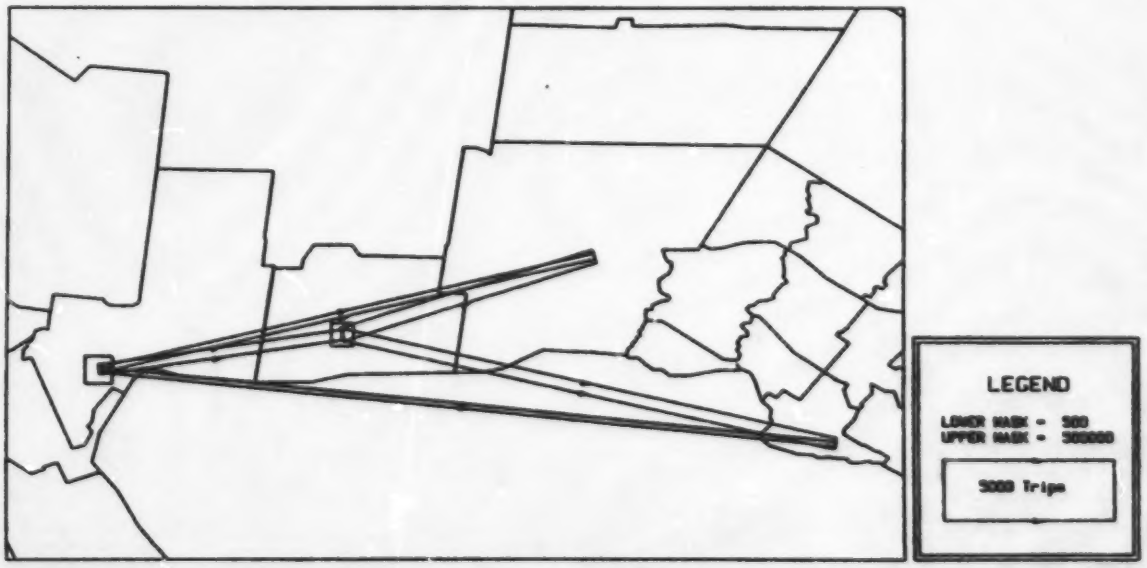

Figure 37/ Changes in Commuting Produced by Burlington and Oakville between 1981 and 1986

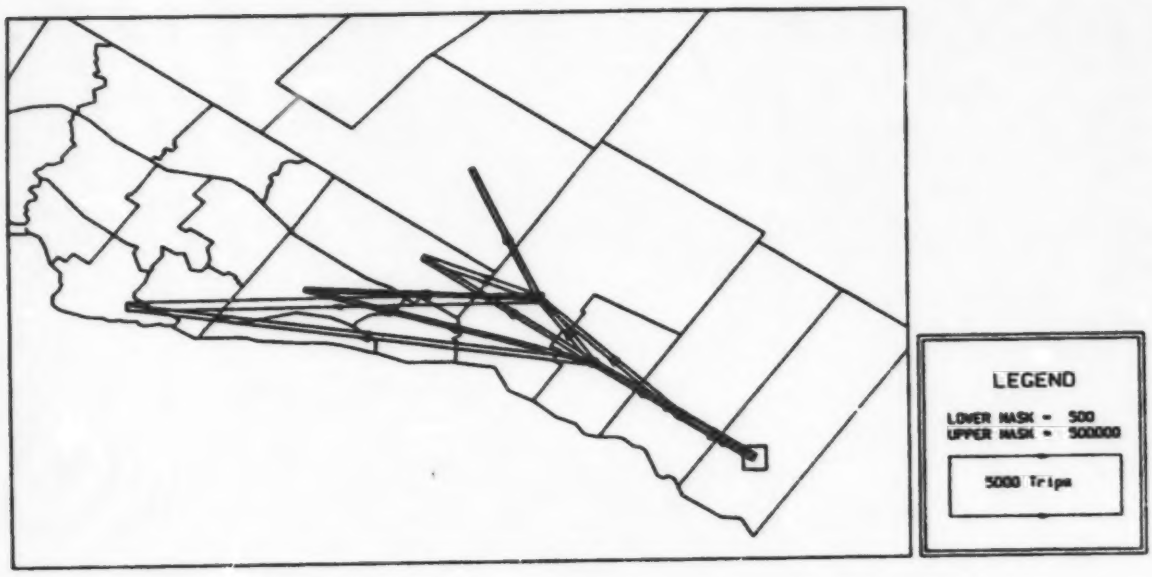

Figure 38/ Changes in Commuting Produced by Durham Region between 1981 and 1986

5/ INFLUENCE OF DEVELOPMENT PATTERNS AND TRANSPORTATION FACILITIES ON COMMUTING STRUCTURE

It is well known that the total commuting effort required to support an urban region is a function of the spatial distributions of labour force and employment and the lengths of the commuting linkages connecting labour force and jobs. The conceptual framework introduced in Chapter 1 suggested that the spatial distributions of labour force and employment resulted from the development decisions made in the urban land market. Transactions in this market are conditioned by the nature of the location demands (e.g., household size and income, employment type), municipal planning policies, the mobility opportunities provided by the transportation system, and the spatial interdependencies between the labour force and employment markets. Governments have relatively strong control over the nature of the development decisions made at various locations, but little control and influence over the decisions made in the transportation market where these decisions have to do with trip length and modal choice.

Figure 39 illustrates the spatial distributions of the growth in kilometres of work trip travel in the GTA between 1981 and 1986. The right-hand bar represents the growth in the kilometres of work trip travel attracted to jobs in each zone. The diagram shows that the increase in commuting demand between 1981 and 1986 was dominated by travel attracted to jobs in PD#1, Mississauga, Vaughan, and Markham with substantial contributions to the overall increase being made by job growth in Brampton, central Etobicoke, and northern Scarborough.

The left-hand bar in Figure 39 illustrates the growth in the kilometres of work trip travel produced by the labour force resident in the zones. The increase in the residential-based commuting demand was dominated by the outer suburbs that grew rapidly as residential areas between 1981 and 1986 and these include Mississauga, Vaughan, and Markham with substantial increases also occurring in Hamilton, Brampton, northeastern Scarborough, and Durham Region.

It is important to consider the regional balance in the attraction and production of new commuting kilometres. The most important imbalance is in PD#1 where the kilometres of travel attracted were about ten times larger then the kilometres produced. The kilometres of travel attracted also grew at a faster rate than the kilometres produced in Mississauga, central Etobicoke, Vaughan, Markham, and PDs [illegible] and #11 along the Yonge Street corridor. The kilometres of travel produced grew at a faster rate than the kilometres attracted in Hamilton, Oakville, Brampton, and in the residential belt running from eastern and northeastern Scarborough into Durham Region.

An important consideration is the extent to which the production and attraction of new kilometres of commuting travel might have been influenced by planning and transport initiatives and how these increases might have been ameliorated. Objective answers to these questions are not possible using the census data since the behaviour of individual households is not available because of census confidentiality restrictions.

Analysis of the household-based travel data obtained in the 1986 TTS would allow this type of evaluation.

The purpose of this chapter is to comment on some of the development and transportation factors that have conditioned the evolution of commuting demands in the GTA. This analysis focusses on the zones that generated the major increases in commuting effort between 1981 and 1986. The zones that generated the largest increases in commuting kilometres attracted will be discussed first, followed by an analysis of those zones.

5.1/ Principal Sources of New Commuting Kilometres Attracted

Figure 39 shows that the zones with the largest increases in commuting kilometres attracted between 1981 and 1986 are PD#1, Mississauga, Vaughan, Markham, central Etobicoke, and northeastern Scarborough. If household-based data were available then the employment sectors (e.g., office-based versus manufacturing) that contributed most to these commuting increases could be identified along with the characteristics of the households.

5.1.1/ Residential Location Decisions

Urban location theory hypothesizes that households tend to trade-off residential space consumption and location costs with commuting distance. More residential space consumption and lower unit space costs are achieved by increased commuting distances. These decisions are conditioned by household size and household income and urban location models have usually been developed for urban areas with a dominant central employment area. These models suggest that the smaller household sizes would tend to live in apartments that are closer to a major employment area with the larger household sizes being prepared to commute longer distances. The influence of the different transportation modes on these residential location decisions will depend on the relative cost and service characteristics of the modes and the automobile ownership levels of the households. These urban location models usually assume that there is a dominant worker whose characteristics govern these location decisions. While the economic-based urban location models are difficult to implement in large multi-centred urban regions, they do offer a conceptual window on household location behaviour.

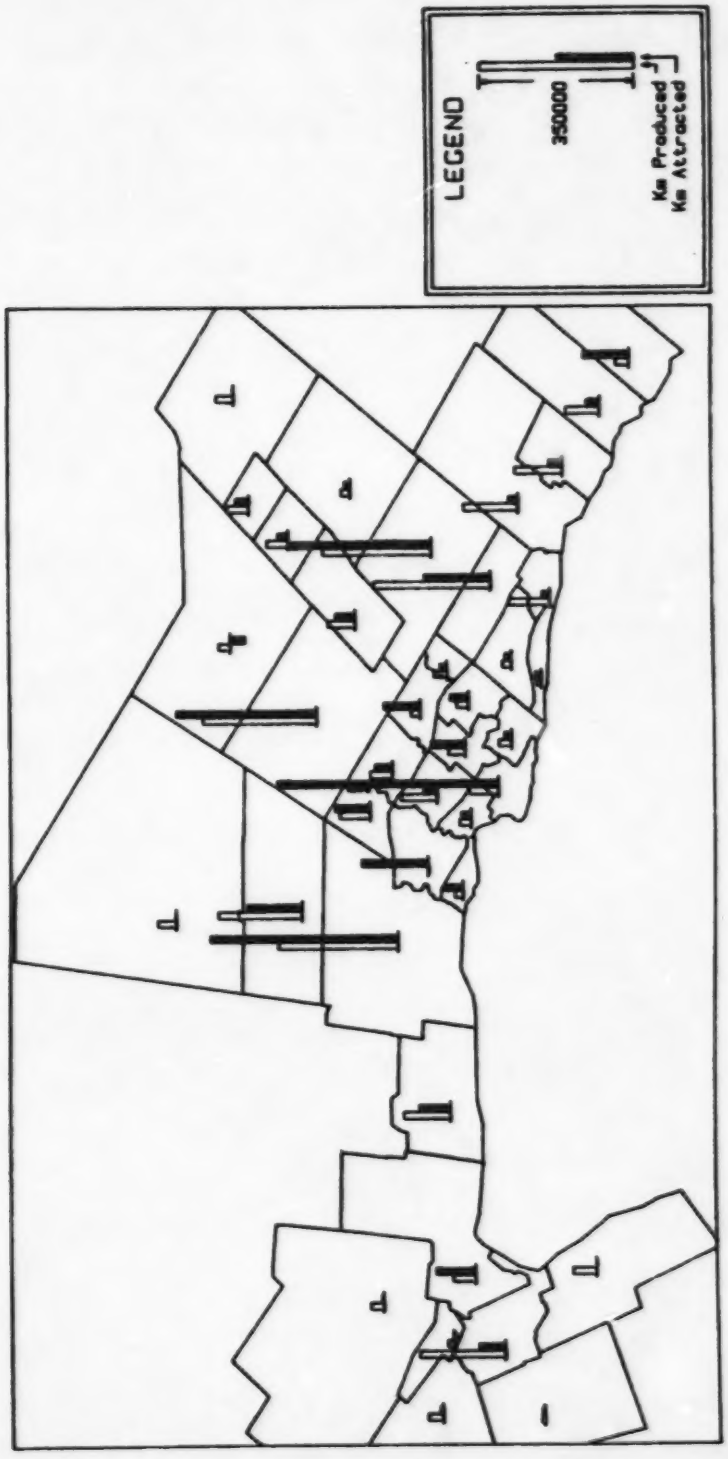

Figure 39/ Increase in Commuting Kilometres Attracted and Produced between 1981 and 1986

5.1.2/ Planning District No. 1

The growth in commuting linkages to PD#1 illustrated in Chapter 4 showed that they were a combination of shorter distance trips from the inner suburbs (particularly from within PD#1) and longer distance trips from the outer suburbs. The largest increases in commuting trips attracted to PD# 1 were from the outer suburbs, particularly north-eastern Scarborough, Markham, and Vaughan. The increase in commuting kilometres attracted to PD#1 resulted from an increase in employment and an increase in the average trip length from 13.8 km to 14.6 km.

One might hypothesize that the shorter distance commuting trips would be by labour force from the smaller household sizes and the longer distance trips from the outer suburbs would be by labour force living in the larger households. It is not possible to test this hypothesis at this time since the location and travel behaviour of households stratified by household size and income is required. However, a general indication is provided by Figure 40 which illustrates the percent of the labour force living in a planning district and working in PD#1 versus the average household size in the planning district. The information in this diagram has to be interpreted carefully as there are strong spatial associations between household size, car ownership, and distance to the employment area. The diagram indicates that participation in PD#1 employment increases as the number of smaller households in an area increases.

The influence of the socio-economic characteristics of the resident labour force on participation in PD#1 jobs may also be detected in Figure 40. For example, a comparison of PDs #6 and #7 shows that participation from the lower occupation status PD#7 is significantly lower than from PD#6, a planning district that has undergone significant gentrification. In 1986, PD#7 in southern Etobicoke, had not undergone such a transformation in its resident labour force. Similar socio-economic effects may be detected by comparing the higher occupation status residential areas in the north-eastern corner of Metro (#15 and #16) with the lower occupation status zones in the northwestern corner (#9 and #10).

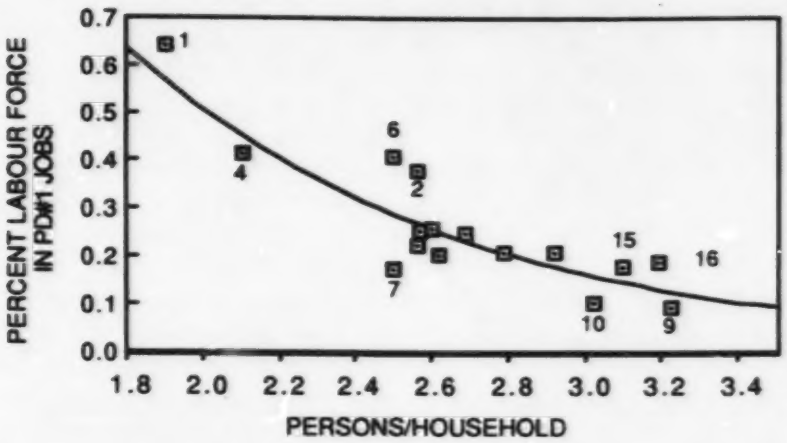

Figure 40/ Percent Labour Force Working in PD#1 Jobs vs Average Household Size in 1986

5.1.3/ Markham and Vaughan

The increases in commuting effort required to support the job growth in Markham and Vaughan were about equal in spite of the fact that employment in Markham increased by about 28 000 between 1981 and 1986, and in Vaughan by about 22 000. The average commuting trip length to jobs was 16.4 km in Markham and 19.7 km in Vaughan. The mean trip length decreased by 0.4 km in Markham, which reflected the strong growth in local employment in Markham as it matured as an urban centre. Vaughan is exhibiting many of the characteristics possessed by Mississauga in the early 1970s when there was a strong occupation status incompatibility between the resident labour force and employment.

The spatial patterns of commuting to jobs in both Vaughan and Markham in 1986 were very diffuse with the freeway system providing the high mobility required by these longer distance commuting trips. Labour force and employment compatibility will improve in Vaughan as it matures as an urban centre.

5.1.4/ Mississauga

The development of Mississauga over the past 20 years provides the example of the long-term development dynamics that might be expected in York and Durham Regions. It developed initially as a bedroom community with very strong commuting linkages to PD#1. Manufacturing, warehousing, and other types of blue collar employment grew rapidly but much of the necessary labour force had to commute from the blue collar residential areas within the western suburbs of Metropolitan Toronto. However, these development trends changed sharply during the late 1970s and 1980s. The supply of lower cost and high-density housing forms expanded sharply as did the white collar employment opportunities.

The dominant feature of commuting changes within Mississauga between 1981 and 1986 was the massive increase in intra-zonal commuting. Employment growth in Mississauga between 1981 and 1986 was almost double that of Markham but the increased commuting kilometres attracted were only one-third higher than Markham. This is reflected in the average trip length of 16.4 km in Markham and 12.9 km in Mississauga, and the 0.6 km reduction in this average between 1981 and 1986.

5.2/ Principal Sources of New Commuting Kilometres Produced

Figure 39 has shown that the principal sources of new commuting kilometres produced between 1981 and 1986 were Hamilton, Mississauga, Brampton, Vaughan, Markham, and northeastern Scarborough. As well, Pickering and Ajax produced substantial amounts of new commuting travel given their smaller resident labour forces. The labour force and the trip length characteristics of these areas are summarized in Table 10.

Table 10/ Labour Force and Trip Length Characteristics of Selected Residential Areas

Area	Resident Labour Force Increase	1986 Mean Trip Length	1981-1986 Change
Hamilton	10 000	6.3	1.7
Oakville	9 000	16.2	0.2
Mississauga	45 000	1.8	-1.4
Brampton	26 000	13.3	-1.0
Vaughan	20 000	17.7	0.8
Markham	24 000	17.6	-1.6
Scarborough (PD#16)	24 000	16.6	-0.4
Pickering	8 000	23.8	-0.2
Ajax	6 000	20.5	0.7

The resident labour force of Hamilton increased marginally between 1981 and 1986 and the employment decreased. The increased production of commuting kilometres by the labour force resident in Hamilton reflected the increases in commuting to jobs in Stoney Creek, Burlington, and to a lesser extent to jobs in the Toronto CMA.

Long distance commuting between Oakville and jobs in Mississauga, Etobicoke, and PD#1 continued to increase and these long commuting distances produced substantial increases in commuting effort. The table entry indicates that the average trip length for Oakville increased marginally between 1981 and 1986.

The development dynamics of Mississauga have been described earlier. The table entries indicate that the resident labour force of both Brampton and Mississauga increased substantially between 1981 and 1986 but that the average trip length decreased as the amount of intra-zonal community increased.

The development characteristics of Vaughan, Markham, and PD#16 are quite similar in terms of the residential labour force. They have strong linkages with jobs in PD#1, jobs along the Highway 401 corridor, and intra-zonal commuting has increased substantially in both Markham and PD#16 resulting in reductions in mean trip lengths. The occupation status incompatibility between resident labour force and employment in Vaughan has been mentioned previously. It is clear that this has stimulated the very different changes in commuting linkages produced and attracted by Vaughan.

The long mean trip lengths of the labour force resident in Pickering and Ajax reflect the important influences that GO Transit and the Highway 401 corridor have had on the commuting linkages with jobs in PD#1 and Scarborough. The small reduction in the mean trip length for the labour force resident in Pickering reflects the increasing local job opportunities.

5.3/ Development Dynamics on the Metropolitan Fringe

The development dynamics observed in the areas that have developed on the fringes of the GTA over the past 25 years would suggest that four phases of development may be identified and these are listed in Table 11. Two sub-phases of phase 3 are identified in Table 11. Phase 3A has local employment that is reasonably compatible with the residential labour force and intra-zonal commuting growth is stimulated. Phase 3B has a local employment base but the occupation status of the employment is incompatible with the occupation status of the resident labour force and different out- and in-commuting patterns are stimulated.

Table 11/ Stages of Development on the Urbanizing Fringe

Stage	Type of Development	Current Examples
1	• local community with very modest linkages to the urbanized region	• small towns in the northern parts of Peel and Durham Regions
2	• emergence as bedroom community for longer distance middle income commuters	• Georgetown, Bolton, Burlington, Ajax
3A	• continued growth of commuter population and emergence of local population serving employment	• Pickering
3B	• growth of commuter population & stimulation of in-commuting because of labour force-job status incompatibility	• Vaughan (formerly Mississauga)
4	• growth of basic employment in manufacturing, industrial parks, office concentrations	• Mississauga, Brampton, Markham

The development dynamics in the GTA over the past 25 years show that many of the outlying communities become more self-contained as they mature, and because of this, impose moderating commuting demands on the regional-level transportation facilities. In spite of this, these areas still impose fairly massive transportation demands on the regional-level transportation facilities. Increasing traffic congestion will result in feedback effects in the urban system, where mean commuting trip lengths will decrease.

Unfortunately, the high mobility available in the earlier stages of development tend to encourage long trip lengths as commuters seek to trade-off cheaper housing prices with increasing travel effort, and because of this, large increases in vehicle kilometres of travel. While governments have reasonably strong control over land development, trip making behaviour can only be influenced in a very limited way. Of course, the adoption of link-based road pricing could have an important impact on transportation market decisions and vehicle travel kilometres.

6/ CONCLUSIONS

The changes in commuting in the GTA between 1981 and 1986 are strongly related, not only to the spatial distributions of growth in labour force and employment, but also to the occupation status biases in these distributions. The spatial biases in the distribution of labour force are related to the mix of housing types provided and the accessibility to compatible jobs provided by the transportation system.

Many of the socio-economic characteristics, such as household size, female labour force participation, and occupation status, that changed rapidly between 1971 and 1981 tended to stabilize between 1981 and 1986. The employment base of the GTA continued to shift towards the business, community, and personal services sectors. The manufacturing sector moved from being the most important employment sector in 1961 to the third rank in 1986.

Inbound commuting flows across the GTA border continued to increase. The municipalities with the largest participation rates in GTA jobs in 1986 were Dufferin, Simcoe, and Wellington. While these external linkages are a relatively small fraction of total commuting demand, they represent a major load on the provincial freeway system, where this is exacerbated by the long trip lengths.

The increased commuting demands attracted to jobs in PD#1 consisted mainly of trips attracted from the new labour force resident in PD#1 and trips from the higher occupation status outer residential areas such as Vaughan, Markham, northeastern Scarborough, Burlington/Oakville, and increasingly, Durham Region. The mean trip length to jobs in PD#1 continued to increase, but at a slower rate than between 1971 and 1981. The geographic expansion of the PD#1 commutershed was balanced partially by the growth in intra-zonal commuting. Commuting from the outer residential areas was facilitated by the the regional transit and freeway networks with commuting demand being equally split between the modes.

Increased commuting within Mississauga was by far the most important commuting change between 1981 and 1986. The massive increase in resident labour force (45 000) and employment (52 000) generated this large increase in intra-zonal travel. The increased self-containment of Mississauga resulted in a reduction in the mean work trip length.

The major change in commuting within Metropolitan Toronto was the growth in commuting produced by the new residential development in northeastern Scarborough. The most important component of this change was travel to PD#1, although commuting to jobs within Scarborough also increased. The commuting growth to PD#1 reflected the higher occupation status of the labour force in this area and the good accessibility provided by both public transportation and freeways.

Important commuting changes were also produced by labour force and job growth in York Region. Markham continued to be a preferred residential location for the larger

households in the higher occupation status groups. Commuting increases occurred to PD#1 and intra-zonal commuting grew as local higher occupation status employment increased.

The commuting changes generated by Vaughan had a different character which reflected the occupation status incompatibility between resident labour force and jobs. The higher occupation status labour force developed strong commuting linkages with jobs in PD#1 and the office-based sectors in North York. The lower occupation status employment in Vaughan attracted labour force from within Metropolitan Toronto, where the freeway system was a strong contributor to the development of this commutershed.

The western sections of Durham Region (Pickering/Ajax) produced commuting increases to jobs in PD#1 and Scarborough as well as intra-zonal commuting. The job growth in Oshawa provided an important regional development balance in the eastern section of the region and generated substantial amounts of local commuting.

The commuting linkages produced by Oakville and Burlington reflected the high occupation status of their resident labour forces as well as the high mobility provided along the Lakeshore corridor. Long distance commuting to PD#1 and Mississauga continued to increase from these communities.

Labour force resident in Hamilton increased but employment decreased. Commuting between Hamilton and Stoney Creek, and to a lesser extent within the Toronto CMA, increased. Continued expansion of GO Transit services along the Lakeshore corridor to Hamilton, and the erosion of its employment base, will accelerate its integration into the Toronto commutershed.

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APPENDIX - 46 ZONE SYSTEM MAP